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METALS and ALLOYS

The Magazine of Metallurgical Engineering

PRODUCTION • FABRICATION • TREATMENT • APPLICATION

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Highlights

WRITTEN BY THE ABSTRACT SECTION EDITORS AND THE EDITORIAL STAFF

Do you want to know what metallurgical engineers are saying, the world over? Look in the Current Metallurgical Abstracts. Here are some of the points covered by authors whose articles are abstracted in this issue.

Polarized Light

Microscopic examination of metals by polarized light is something relatively new. Readers familiar with American experience with this tool might like to compare notes with European workers. This can be begun by reading the contributions of Schafmeister and Moll (page MA 370L8) and von Schwarz and Daschner (page MA 370L7). The first is devoted mainly to constituents commonly found in ferrous materials; the second reviews the underlying theory and describes the technique. Perhaps the relatively cheap screens recently put on the market will lead to even routine examination by polarized light.—J.S.M.

Clad Metals

The recent increased interest in the use of "clad," "duplex," or mechanically plated metals has raised several questions as to the physical properties of such combinations. Data given by R. Müller (page MA 374R2) indicate that in general there is an increase in the tensile strength with no loss in ductility when steel is mechanically plated with 10% Cu, Ni, Monel metal or 18 and 8.—V.V.K.

Fatigue vs. Corrosion-fatigue

Considerable data are extant on the endurance limits of various steels; a lesser amount on endurance limits under corrosive conditions. We know that the corrosion of the surface of the steel will lower its endurance limit. Any process affecting the susceptibility of the surface to corrosive attack will therefore have a profound influence on the physical properties of steel under conditions of alternating stress. Further data on this point are given by A. Jünger (page MA 377R9). Few structures are designed that are not subject to alternations of stress, whether slow or rapid, or to corrosive influence of some description. It should follow that the designer should not only know the intrinsic fatigue properties of the steels used, which incidently represent the maximum properties under the most favorable conditions, but should also know what fatigue properties those steels possess under corrosive conditions. This would call for the institution of a corrosion-fatigue test as one of the standard physical property tests. To do this it would be necessary to determine what corrosive conditions would best represent actual service conditions, which is still a bug-a-boo in corrosion testing. However the multitudinous researches of McAdam and data from many other sources, if properly correlated, should give us a start in the right direction. The question is certainly important enough to justify some intensive work along that line.—V.V.K.

Katydid and Katydidn't

The old hypothesis of amorphous metal occurring between crystals, advocated by Rosenhain, has been pretty well exploded. The assumption that an amorphous (Beilby) layer exists on a polished metal surface as a result of cold work is now being examined, with heated arguments on both sides. Finch (page MA 370L3) thinks it exists, Dobinski (page MA 370L2, 5) and Collendar (page MA 370L4) say what electron diffraction is mistakenly interpreted as showing to be amorphous is just an oxide film.—H.W.G.

Low Temperature and Bessemer Steel

A couple of Russian investigators (page MA 375L5) report that heavy machinery stored at —20° C. suffered an epidemic of cracking and relate this to the poor impact resistance at that temperature. Epstein clarified our knowledge of this low temperature brittleness several years ago, and that part of it is no mystery. But why should low impact material fail without impact, by just sitting around? Thermal contraction could apply stress all right, but one would hardly expect to produce the conditions of an "angle bend test" and brittle failure in that way.—H.W.G.

Sulphur Limits

The long-drawn out project on S in steel (page MA 375L2) is at last wound up and reported, with sensible conclusions on the lack of effect of what formerly would have been termed excessive S in soft steels. It is a pity, though, that the work could not have been carried on in equally thorough fashion to the evaluation of S (or similar inclusions) in very hard steels. Only the unthinking would extrapolate the conclusions and make them apply to spring steels, bearing races and the like, but unfortunately there are always people who don't think.—H.W.G.

The Old Gray Mare

Lewis (page MA 377L2) shakes some of the mystery out of the allegation that prewar ship plate was better than post-war, by tying the behavior in corrosion up with the type of scale.—H.W.G.

Graphitization

The effect of oxidation and deoxidation on the type of graphite produced in cast iron is taken up in some exceedingly interesting abstracts (pages MA 344R1, 4; MA 345L1).—C.H.H.

Rails

Lückerath (page MA 348L3) describes roll pass profiles for rolling rails aimed to produce better orientation of fiber.—H.W.G.

Graphite

Jennings' comment (page MA 349R3) on graphite as a die lubricant reminds us of another recently reported application, sowing peas in a drill. The peas tend to jam in the tubes of the drill and then split, and split peas are better for soup than for seed. So the farmer adds a little graphite and all goes smoothly.—H.W.G.

General Surveys

Several articles of the correlated abstract type are mentioned in this month's abstracts, notably Henzel on Mn bronze (page MA 342R1), Crown on Al bronze (page MA 341R10), Thews on battery scrap (page MA 341R8), Gohn on forming properties of non-ferrous sheet (page MA 349R2), Hurst on heat-treating cast iron (page MA 354R2), and Jennings on welding in general (page MA 359R10). More power to such authors.—H.W.G.

Fluidity

There's enough work being done on fluidities these days to fill a book. Three abstracts take you into cast iron (page MA 344L2), oxide systems (page MA 345L5), and open-hearth slags (page MA 345L3). Maybe some day we'll speak in terms of "poises" instead of "thick" and "thin."—C.H.H.

Impact Strength and Notch Sensitivity

Always authoritative are articles by Piwowarsky; in a recent paper (page MA 368R2) he supports previous contentions that impact velocity affects the observed value of impact strength, and declares that casting skin is without effect on the test.—F.P.P.

Rail Ends

In spite of the trend toward heat treatment of rail ends in the mill, or in the track, Bronson (page MA 359L9) thinks that the control of heat-treatment conditions is poor and the results not worth the cost over merely building up the worn end by arc welding when it becomes worn down.—H.W.G.

Some Good Dope

The literature of welding is so prolific and so many of the articles published tell so little that it is wearisome even to read a month's abstracts on welding, to say nothing of the original articles. As a welcome change comes a recent issue of J. Am. Soc. Naval Engineers, in which there are articles with real meat in them. For example Chapman (page MA 360R1), Stewart (page MA 360L7), Hodge (page MA 359R2), and Ronay (page MA 360L2).—H.W.G.

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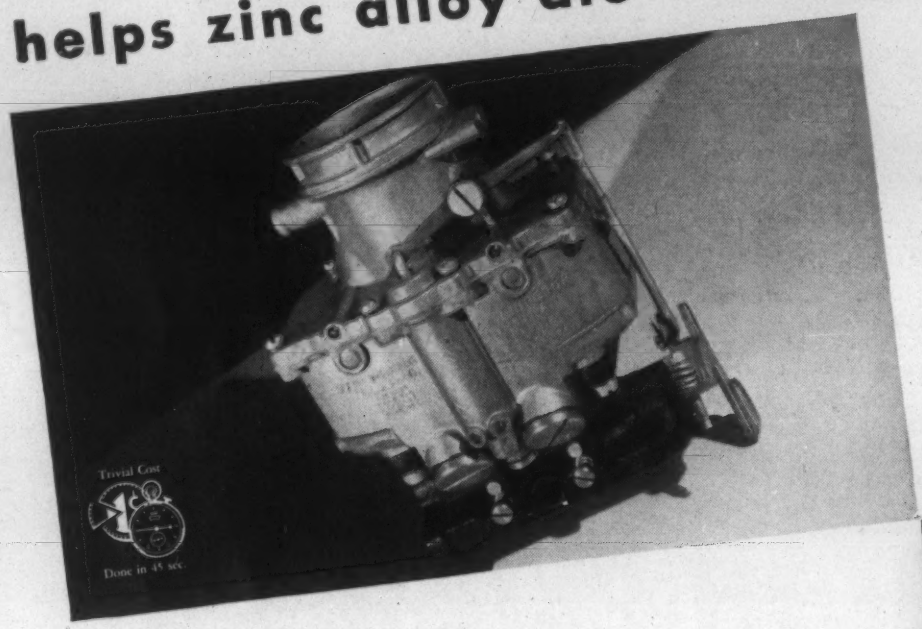

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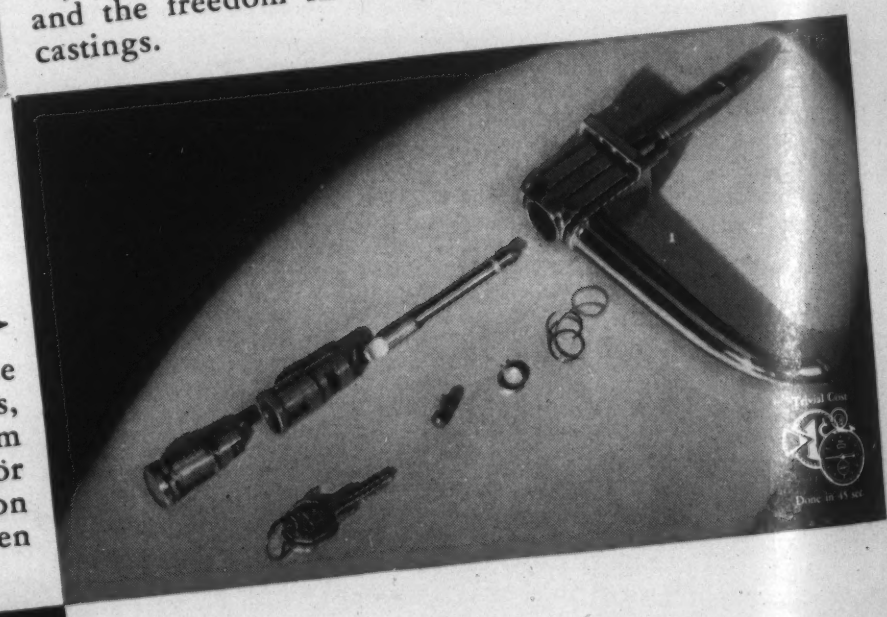

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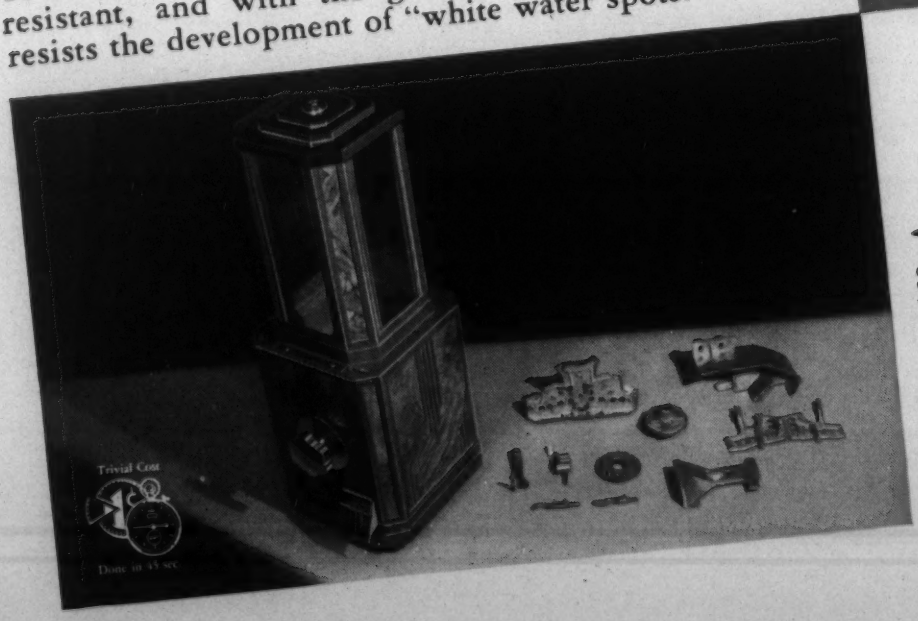

←. . . SALT AIR AND MATERIALS

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EDITORIAL

Let's Split Some Hairs

Some engineers with a mechanical rather than a metallurgical background are puzzled by the apparent interchangeability of alloy steels, in that the tensile properties, as given by the S.A.E. property curves, show that when the steels are drawn back to the same hardness, they are almost indistinguishable. If technical salesmen from an alloy steel plant recommend a particular alloy steel for a particular service on the basis of their more intimate knowledge of the idiosyncrasies of different steels in actual use—since they have such a knowledge of their own steels, at least, through their trouble shooting activities,—the purchaser's engineer may feel that the salesman is attempting to put something over.

It would be a great help if the fine-haired distinctions that influence the experienced alloy steel man to make his recommendation could be recorded in quantitative test figures rather than in more vague terms of practical experience. What are the actual differences that exist behind the apparent sameness of the tensile properties of 1-in. diameter bars on which the handbooks and catalogs present data? When the steels are to be heat treated in heavy sections, of course, the depth hardening properties count. While the depth hardening properties of the S.A.E. and other less common commercial steels are fairly well known in a qualitative and relative fashion, definite quantitative data, obtained by comparable testing technique so that really close comparisons can be made, are available for only a small number of these steels, and what data are available are based on composition alone without distinction as to inherent grain-size and grain coarsening characteristics.

We understand that the A.S.M. is considering an attempt to clarify this situation, and such an effort would be praiseworthy. However, this will not go very far toward clarifying the whole situation.

The alloy steel man knows that some steels, whose properties in acceptable bars may be just like those of some other composition, do not produce in the mill as high a proportion of acceptable bars, and that in those that do pass the minimum specifications on inspection, the tendency for "scatter" in properties is greater. Some types of steel are relatively insensitive to slight changes in finishing conditions, or in chemistry (i.e., the composition can vary anywhere in the S.A.E. specification ranges without much difference in behavior), while others are highly sensitive, so that exacting purchasers who heat treat under automatic control and cannot vary the treatment to accommodate differences between different lots, are forced to set up their own more narrow and more stringent requirements. Such information is fragmentary, scattered among different steel makers and different large users, and seldom discussed in print.

An S.A.E. committee, headed by Janitsky, made a start along the proper road some ten years ago when it studied four heats of 3130 and four of 6130 and set forth the results by plotting probability curves, i.e., on a statistical basis. These data are seldom copied or quoted. The curves appear in the S.A.E. Handbook but we can't find them in the 1936 A.S.M. Handbook, perhaps because their appearance would so clearly show the unfilled need for similar and up to date information on all the other steels. The original intention, if our memory serves, was to do likewise for all the S.A.E. steels, but the plan fell by the wayside. One has only to study the effects of variation in C and Mn content shown by these curves to realize that the S.A.E. and other similar "property curves" tell only about half the story.

If one had curves assembled on a probability basis for a lot of different heats, with the grain size characteristics differentiated, for a large group of S.A.E. steels that are cheaper and more used today than the couple that were picked to start that type of studies ten years ago, some of these fine-haired differences would no longer be so puzzling.

It would be a man-size and very expensive job to do this sort of thing for all classes of commercial carbon and alloy steels, of various grain sizes, and with specimens of a sufficient range of sizes to show the effect of mass. Yet the whole job ought to be done. Much of the data doubtless exists, and it might be collected and summarized, leaving only the gaps to be filled by new tests, but it could only be collected by some impartial agency, such as the Bureau of Standards or a committee of the A.S.T.M., A.S.M. or A.I.M.E. Of course, the S.A.E. could finish what it started, but since it is more of a steel user than a steel producer organization, some society representing both groups might distribute the burden more equitably. The A.S.T.M. is very wide awake to the importance of the statistical method of approach to problems of testing and specifications, and could approach the problem with a favorable background. Indeed, the matter has so important a bearing that joint attack by a coalition of all the interested societies would be very much in order.

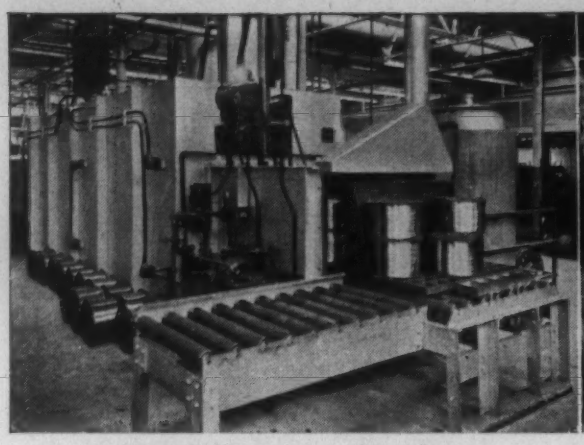
Until the broad question is thus attacked, it would be interesting if individual producers would set forth their own data in such fashion. We think a catalog containing such data, rather than the time honored property charts, would make quite a hit.—H. W. G.

Copper and Tin in Deep Drawing Steels

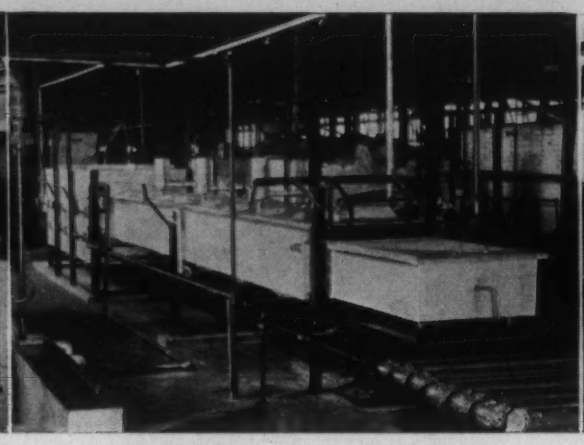
It is felt by some open-hearth furnace operators that the time is not far distant when each heat of carbon steel will have to be carefully controlled as to the presence of alloying elements. With the growing use of alloy steels, particularly in the near future of the low-alloy, high-elastic steels, scrap contamination from alloys will increase. According to investigations of the Battelle Memorial Institute published each year, the presence of residual metals in steel has not reached alarming proportions, but the possible menace is there.

That the regulation referred to is likely to come is fore-

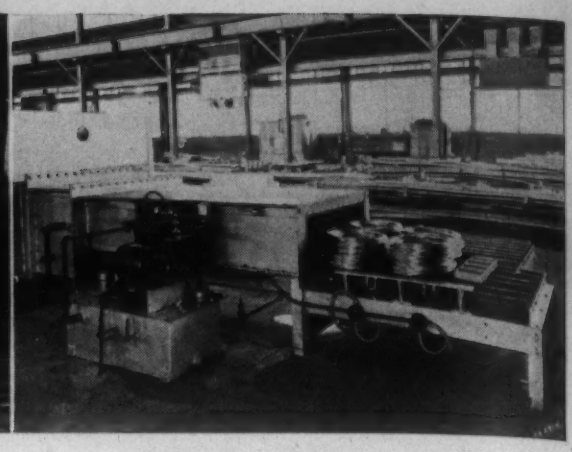
(Continued on page 157)



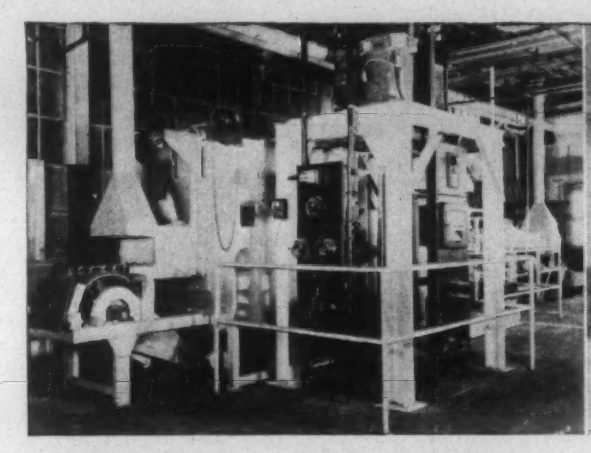
BRIGHT ANNEALING WIRE
—on large reels



BRIGHT ANNEALING WIRE
—on small spools



BRIGHT ANNEALING WIRE
—in coils



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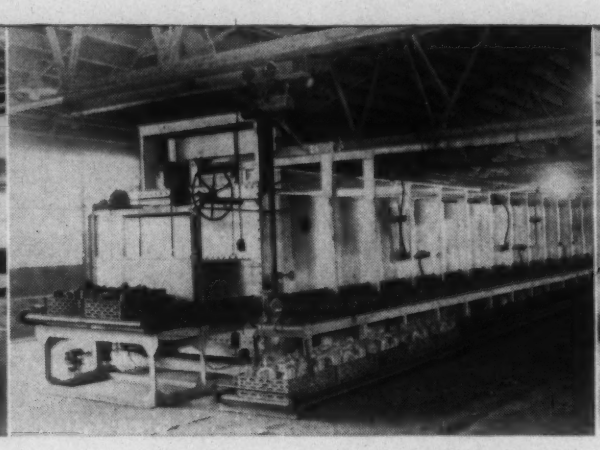
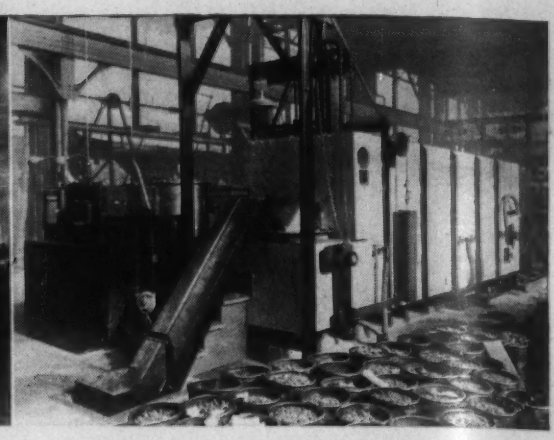
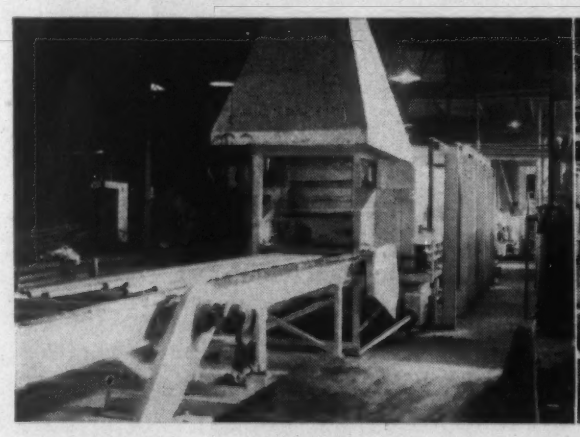


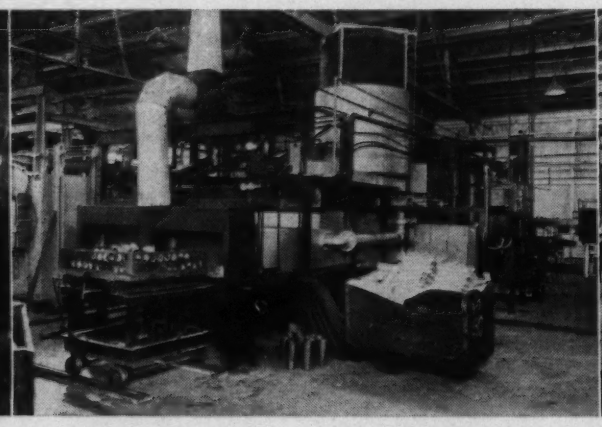
CLEAN ANNEALING SHORT CYCLE MALLEABLE CASTINGS



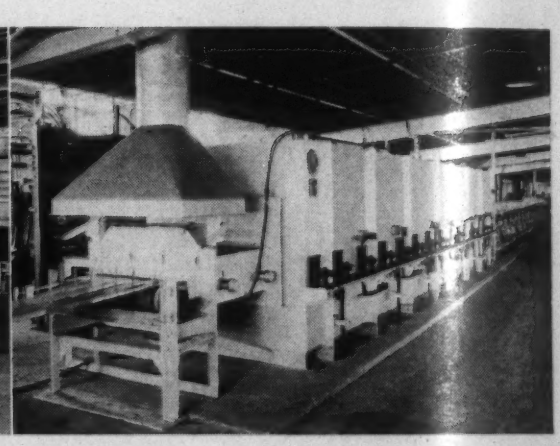
SCALE FREE HARDENING BOLTS
—in chain belt furnaces



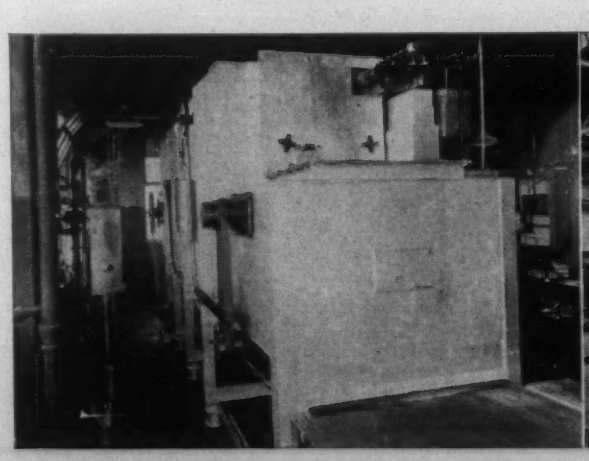
BRIGHT ANNEALING TUBING
—continuously



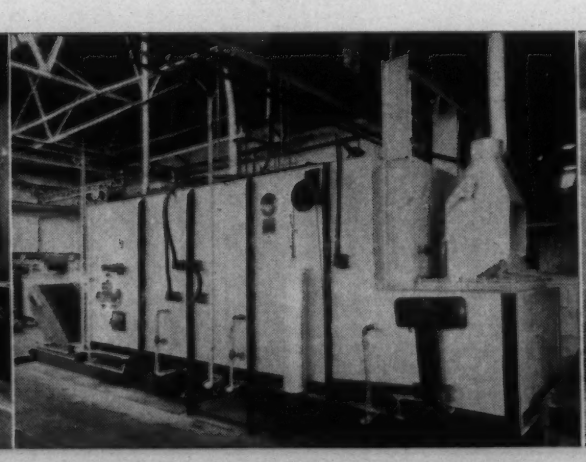
BRIGHT ANNEALING STAMPINGS
—continuously



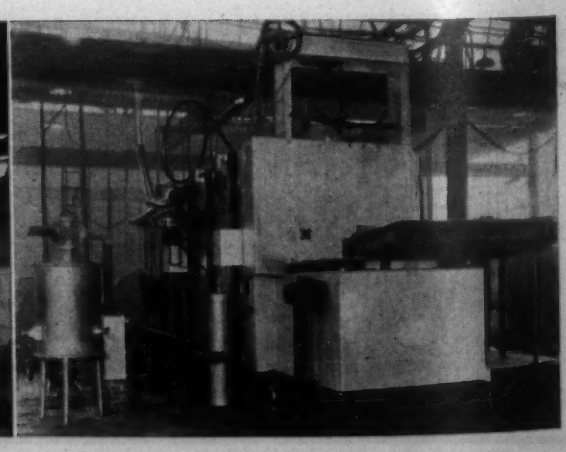
BRIGHT ANNEALING STRIP
—continuously



SCALE FREE HARDENING BOLTS
—400 lbs. per hour



CLEAN HARDENING SMALL PARTS
—800 lbs. per hour



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CLASSIFICATIONS

1. ORE CONCENTRATION

Crushing, Grinding & Plant Handling (1a), Gravity Concentration (1b), Flotation (1c), Magnetic Separation (1d), Amalgamation, Cyanidation & Leaching (1e).

2. ORE REDUCTION

Non-Ferrous (2a), Ferrous (2b).

3. MELTING, REFINING AND CASTING

Non-Ferrous (3a), Ferrous (3b).

4. WORKING

Rolling (4a), Forging & Extruding (4b), Cold Working, including Shearing, Punching Drawing & Stamping (4c), Machining (4d).

5. HEAT TREATMENT

Annealing (5a), Hardening, Quenching & Drawing (5b), Aging (5c), Malleableizing (5d), Carburizing (5e), Nitriding (5f).

6. FURNACES, REFRACTORIES AND FUELS

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Soldering & Brazing (7a), Welding & Cutting (7b), Riveting (7c).

8. FINISHING

Pickling (8a), Cleaning, including Sand Blasting (8b), Polishing & Grinding (8c), Electroplating (8d), Metallic Coatings other than Electroplating (8e), Non-Metallic Coatings (8f).

9. TESTING

Inspection & Defects, including X-Ray Inspection (9a), Physical & Mechanical Testing (9b), Fatigue Testing (9c), Magnetic Testing (9d), Spectrography (9e).

10. METALLOGRAPHY

11. PROPERTIES OF METALS AND ALLOYS

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12. EFFECT OF TEMPERATURE ON METALS AND ALLOYS

13. CORROSION AND WEAR

14. APPLICATION OF METALS AND ALLOYS

Non-Ferrous (14a), Ferrous (14b).

15. GENERAL

Economic (15a), Historical (15b).

1. ORE CONCENTRATION

JOHN ATTWOOD, SECTION EDITOR

A Revival of Lead Mining at Halkyn, North Wales. J. B. RICHARDSON. *Bulletin of the Institution of Mining & Metallurgy,* No. 387, Dec. 1936, 60 pp.; No. 388, Jan. 1937, pp. 3-39. The mill is described. Consumption of flotation reagents per ton of feed, is soda ash 0.525, thiocarbanilide 0.056, NaCN 0.200, Na_2S 0.699, K amyl xanthate 0.033, $CuSO_4$ 0.667, K ethyl xanthate 0.138 and cresylic acid 0.242 lb. AHE (1)

Mining and Milling Methods and Costs Hog Mountain Gold Mining & Milling Co., Alexander City, Ala. N. O. JOHNSON. *United States Bureau of Mines, Information Circular* No. 6914, Nov. 1936, 23 pages. The ore is crushed, then ground in closed circuit with a Dorr classifier. The overflow is floated to give a 3 oz. concentrate. The middling is reground, the tailing goes to waste. Reagents are cresylic acid 0.38, fuel oil 0.03, amyl xanthate 0.05 and Na aerofloat 0.03 lb./ton. Costs total $1.483/ton of ore. See *Metals and Alloys*, Vol. 7, Mar. 1936, page MA 109L/2. AHE (1)

Gold Mining and Milling in the Black Canyon Area, Yavapai County, Ariz. JOS. R. GUITERAS. *United States Bureau of Mines, Information Circular* No. 6905, Nov. 1936, 51 pages. Milling practices for 6 mines described. AHE (1)

Progress Report No. 2 on Investigation of Detachable Rock-drill Bits. MCHENRY MOSIER. *U. S. Bureau of Mines, Information Circular* No. 6911, Nov. 1936, 20 pages. Use of detachable bits reduced the cost per ft. of hole drilled. At 7 of 10 mines, detachable bits drilled faster. See *Metals and Alloys,* Vol. 7, Aug. 1936, page MA 422 L/2. AHE (1)

The Economic Significance of High-grade Concentrates. PAUL M. TYLER & CARLE R. HAYWARD. *Mining and Metallurgy,* Vol. 17, Dec. 1936, pages 563-566. Discusses the economic importance of highly refined products. Surveys the economic boundary between mechanical concentration and chemical methods, including sundry processes for beneficiating industrial minerals as well as pyrometallurgical and hydrometallurgical processing of ores. Concludes that as milling methods are progressively improved, efforts to produce more highly refined products may be amply rewarded even though present day market specifications fail to provide sufficient apparent financial incentive. VSP (1)

Theory and Practice of Ore Sampling. K. POZHARITSKY. *Tzvetnuie Metallui,* No. 6, July 1935, pages 33-37. Author discusses various methods of estimation of size of sample in relation to the degree of grinding. From experimental data and data taken from literature a graphic method is proposed whereby the logs of sample weights are plotted on the abscissa, and the logs of maximum particle size (or screen mesh) on the ordinate. The advantage of the method is its usefulness for wide range of ore particle sizes. 24 references. BND (1)

Pamour-Porcupine—New Gold Producer of Northern Ontario. A. H. HUBBELL. *Engineering & Mining Journal,* Vol. 137, Oct. 1936, pages 504-506. A 500-ton flotation-cyanidation plant of the Pamour-Porcupine Mines, Ltd., is described. About 35% of the Au is free and is recovered by amalgamation and the remainder associated with sulphides is recovered by flotation and cyanidation. WHB (1)

Design and Operation of a Four-ton-per-hour Gold and Silver Ore-sampling Plant. E. D. GARDNER & W. A. LEDDELL. *United States Bureau of Mines, Information Circular* No. 6891, June 1936, 40 pages. A very complete description with lists of equipment, costs, and detailed drawings. AHE (1)

The Associated Tailings Plant Treats More Than 50,000 Tons Monthly. R. C. BUCKETT. *Chemical Engineering & Mining Review,* Vol. 28, Aug. 8, 1936, pages 379-383. Tailings from the dump of the Associated Gold Mine of Western Australia (New) Ltd. at Kalgoorlie and now a part of the Lake View & Star, Ltd. organization are being treated. A detailed flowsheet and a plant layout are illustrated, and sluicing, agitation and filtration, clarifying and precipitation, and sampling and recovery are outlined. WHB (1)

Concentration and Milling. CHARLES E. LOCKE. *Mining and Met.,* Vol. 18, Jan. 1937, pp. 14-16. Survey of progress in 1936. VSP (1)

Rand Metallurgy and Its Bearing on Australian Practice. H. HARDY SMITH. *Chem. Eng. Mining Rev.,* Vol. 29, Jan 8, 1937, pp. 155-159. A comparative review. Observations in the South African mining fields are noted as regards classification, corduroy concentration, pyrite extraction, stage grinding, cyanidation, and precipitation. It is concluded that Rand ores are simple metallurgically in comparison with those of Australia. WHB (1)

Microscopic Structure and Concentratibility of the Important Iron Ores of the United States. S. R. B. COKE. *U. S. Bur. Mines, Bull.,* No. 391, 1936, 121 pp. Laboratory concentration tests were made on representative ores from 19 properties after microscopic study. Magnetites as a class were most amenable to concentration; ores from Mineville, N. Y., and Hanover, N. Mex., gave concentrates containing less than 0.2% SiO_2; concentrates from no magnetite contained more than 1% SiO_2, owing to coarse association and low silication of the gangue. Concentration difficulties are due to (1) interlocking of hematite laths to retain gangue, and (2) fine interlocking of gangue and limonite, the latter common in most hematite ores. AHE (1)

Laboratory Tests and Milling Practice on British Columbia Gold Ores. W. R. MCCLELLAND. *Trans. Can. Inst. Mining Met.,* Vol. 40, Jan. 1937, pp. 59-74; *Can. Mining Met. Bull.,* No. 297. Results of tests on 35 ores are reviewed briefly. AHE (1)

Roasting "Blue Ores" at the Maitland Mine. L. B. EAMES & ROY VAN ZANTE (Canyon Corp., Deadwood, S. Dak.) *Eng. Mining J.,* Vol. 138, Mar. 1937, pp. 125-128. The highly siliceous Au ores of the Black Hills require roasting prior to cyanidation and even then afford only 85% extraction. Flowsheet is shown of the Canyon Corp.'s mill at Maitland, S. Dak. Roasting is an important and vital feature of the treatment. The unit capacity is 110 tons daily. The sulfides are converted to sulfates by a relatively long period of gradual temperature increase followed by a short period at 600°C, which temperature is above the decomposition point of Fe sulfate. WHB (1)

Raw Materials; World's Sources of Bauxite. E. C. HARDER. *Times Trade and Eng.,* Vol. 40, Mar. 1937, p. 3. Review. Considers also mining methods and use of cryolite. MS (1)

Concentration of Minnesota Low Grade Iron Ores. GROVER J. HOLT (Butler Brothers) *Mining Congr. J.,* Vol. 22, Dec. 1936, pp. 20-23. The success in treatment of the vast reserves of low grade Minnesota ores depends upon economic consideration rather than on metallurgy. Mesabi low grade magnetite has been successfully concentrated by way of fine crushing and magnetic separation. The western Mesabi hematite ore will respond to the same treatment provided it is roasted to magnetite prior to the magnetic separation. No other process has yet been proved a metallurgical success. Flotation has been attempted in laboratory experiments but so far without success. The ultimate treatment of low grade ore must await a time when Fe ore will command higher prices than at present. BHS (1)

1a. Crushing, Grinding & Plant Handling

Comparison of Low vs. High Discharge for Ball Mills. E. L. LONGMORE AND THE HOLLINGER MILL STAFF. *Trans. Can. Inst. Mining Met.,* Vol. 40, Feb. 1937, pp. 85-109; *Can. Mining Met. Bull.,* No. 298; *Bull. Inst. Mining Met.,* No. 387, Feb. 1937, 23 pp. At slightly lower power consumption and at lower overall costs per ton, a low discharge mill will grind more tons of ore to a given fineness than will a high discharge mill of the same type. A mill 6½ ft. in diameter and 14½ ft. long will grind 93.3% of the tonnage that 2 mills of the same diameter but half the length will grind. Maximum economy and capacity were obtained at 80% of critical speed and a ball load of 50% of mill volume. Classification and raking capacity equivalent to a 12 ft. x 27 ft. 4-rake classifier of the Dorr FX type is required for economical operation of a 6½ x 14½ ft. low-discharge ball mill. Total costs of breaking and grinding to mill-feed size were 17.62 cents/ton. AHE (1a)

Mining Practice. W. G. MCBRIDE. *Eng. Mining J.,* Vol. 138, Feb. 1937, pp. 88-90. Review of new developments in blasting, drilling, stoping, filling, sinking and other operations. WHB (1a)

1b. Gravity Concentration

The Recovery of Alluvial Gold. D. CAMPBELL MACKENZIE. *Trans. Can. Inst. Mining Met.*, Vol. 40, Feb. 1937, pp. 110-116; *Can. Mining Met. Bull.*, No. 298. To recover fine Au, the recommended procedure is as follows: Classify gravel before it reaches the sluice box, spray with high-pressure water, use expanded metal riffles, use a trommel screen as an initial classifier, use wide sluice boxes with a fall of at least 1 ft. in 12, save all black and gray sands by use of undercurrents, and clean up often. AHE (1b)

1c. Flotation

Flotation—Firmly Intrenched as a Means of Concentration—The Art Makes Some Gains. A. M. GAUDIN. *Eng. Mining J.*, Vol. 138, Feb. 1937, pp. 96-97. Applications of flotation to sulphide ores, to Au ores, in coal mining, in the field of oxidized ore of Pb, Zn, and Cu, and in non-metallics are outlined. Removal of C from waste paper pulp by flotation is a recent process. WHB (1c)

Flotation of Witwatersrand Ore Products (Laboratory Results). ANDREW KING. *J. Chem., Met. Mining Soc. S. Africa*, Vol. 36, Sept. 1935, pp. 52-54. Discussion. See *Metals and Alloys*, Vol. 6, Oct. 1935, p. MA 387L/9. AHE (1c)

Lead Waste-heap Ore Flotation, the "New Hope" of Bleialf in the Eifel (Die Blei-Holdenerz-Flotation "Neue Hoffnung" Zu Bleialf in der Eifel) A. GÖTTE & A. STIELER. *Metall und Erz*, Vol. 33, June 2, 1936, pages 320-324. Application of flotation methods to this mine has made possible the use of large quantities of waste ore. Types and composition of deposits and complete description of process, with flow sheet and cost data, are given. FPP (1c)

Selective Flotation of Galena—Regrinding and Reagents Compared. R. D. NEVETT. *Chemical Engineering & Mining Review*, Vol. 28, Aug. 8, 1936, page 395. Flotation at Broken Hill, N.S.W., is conducted in a 10-cell Pb flotation machine. A high grade concentrate is produced from the first 5 cells while the float from the latter 5 cells is a mixed float of galena and marmatite (Zn blende containing appreciable Fe) with a considerable amount of gangue. This float assay varies from 48.7 Pb and 16.7 Zn to 7.1 Pb and 23 Zn. It is refloated in a 4-cell unit giving a concentrate varying from 58.4% Pb and 13.4% Zn to 70.8% Pb and 7.4% Zn. Digestion with cyanide improves the grade a bit while regrinding in a ball mill results in a grade over 80% Pb in one case and over 79% in all cases, with the amount of Zn floated very small. There is obviously some action taking place between the iron balls and the minerals that does not take place between the flints and the minerals. WHB (1c)

1d. Magnetic Separation

The Magnetic Properties of Natural and Artificial Iron-oxygen Compounds (Ueber die Magnetischen Eigenschaften Natürlicher und Künstlicher Eisensauerstoffverbindungen) Part III. The Effect of Heating in Different Atmospheres on the Magnetic Properties of Iron Hydroxide (Die Aenderung der Magnetischen Eigenschaften von Eisenhydroxyden durch Erhitzen in Verschiedener Gasatmosphäre) L. KRAEBER & W. LUYKEN. *Mitt. Kaiser-Wilhelm-Inst. Eisenforsch., Düsseldorf*, Vol. 18, No. 11, 1936, pp. 149-162. Thermal treatment to transform weakly magnetic hematites and other Fe ores to a ferromagnetic form was investigated, the ultimate goal being the attainment of higher yields by magnetic separation and (particularly for German conditions) the utilization of low grade ore. The results show that the hydroxides in the ore play an important part in the transformation. Naturally occurring hydroxides are the α-hydroxide which changes to the peramagnetic iron oxide when heated, and the much rarer γ-oxide; both have the formula $Fe_2O_3.1H_2O$. The two oxides show different behavior at temperatures from 200° to 900°C. in N_2 and CO_2, due to conversation to iron carbonate. A susceptibility maximum was observed at 500°C. in CO. Hydroxides can be easily converted into the ferromagnetic γ-oxide, but iron oxides which have been formed at high temperature cannot be transformed into γ-oxide. Temperatures of highest susceptibility are different for artificial and natural hydroxides; best values are obtained if the reduction temperature is between 550° and 600° and the oxidation temperature between 500° and 550° C. The reaction rates are very high even at 400°C. for both reduction and oxidation, due to loosening-up of the crystal structure with removal of water of crystallization. Roasting as pretreatment for magnetic separation offers very good possibilities. 13 references. See also *Metals and Alloys*, Vol. 6, Feb. 1935, p. MA 68L/2. Ha (1d)

First Magnetic Roasting Plant in Lake Superior Region. E. W. DAVIS. *Metals Technology, American Institute Mining & Metallurgical Engineers, Technical Publication* No. 731, Dec. 1936, 17 pages. A 250-ton roasting furnace constructed by the University of Minnesota and now operated by Butler Bros. is described. The furnace is of the shaft type and reduction of Fe_2O_3 to Fe_3O_4 is brought about by hot reducing gases. The ore is graded as to size before charging, and the fines charged into an interior shaft extending part way down from the top. Baffles insure proper flow of material. The roasted material falls into water at the base of the furnace and rate of flow is regulated by rate at which roast is taken from the water. Oil is used for heating to reduction temperature and for reducing gases. For 1 month the costs per ton of feed were $0.555 for oil, $0.050 for power, and $0.072 for labor. The plant can only be operated at a profit because the material treated is waste. Its applicability to other than waste material depends on possible improvements in the process itself or to decrease in ore cost by decreased taxes and royalties. JLG (1d)

1e. Amalgamation, Cyanidation & Leaching

Experimental Investigation of Chlorination of Copper, Nickel and Iron Bearing Mattes. G. G. URAZOV, I. S. MOROZOV & G. V USTAVSHCHIKOVA. *Tzvetnuie Metallui*, July 1935, pages 109-130. In Russian. Deals mainly with chlorination of mattes. Chlorination processes, although they have been used for a long time, have not found much favor mainly because of insufficient understanding of the chemistry of the process. In smelting all of the Fe and S is lost. In chlorination by Cl gas at high temperatures chlorides of these metals are obtained, and because of their different volatilities the chlorides of Cu and Ni can easily be extracted, and then separated by crystallization. The chlorides are then treated electrolytically, and the S is also recovered from its chlorides. The authors investigated the chemistry of chlorination reactions; influence of temperature, time, composition of chloridizing reagents; separation of the chlorides, and development of general scheme of chlorination process. (1) Chlorination of sulphides and mattes of Ufalei Works by gaseous Cl and S_2Cl_2 at high temperatures was studied by passing Cl through samples heated in porcelain tubes, and analyzing the resulting products. These tests showed that chlorination of Cu_2S is complete in 2½ hours at 330° C.; Ni_3S_2 is chlorinated slower, and the process is completed at 640° C. in 2½ hours. Chlorination of matte is complete in 2½ hours at 340° C. At higher temperatures (375° C.) the volatilization of $FeCl_3$ is 94% complete, while the chlorides of Cu and Ni are not volatilized. In all these reactions an excess of Cl is used, and S_2Cl_2 is formed. If sufficient amount of Cl is used, the S_2Cl_2 formed becomes a chloridizing agent. Cu_2S is converted into Cu_2Cl_2, FeS into $FeCl_3$, and Ni_3S_2 into $NiCl_2$. Elementary S is driven off. Synthetic melts of Cu and Ni sulphides can also be chloridized by S_2Cl_2. The S can be obtained either as S_2Cl_2 or S. The chlorination of Cu-Ni mattes proceeds slower; this is thought to be due to the fact that Ni and Cu present in forms other than sulphides are first converted into sulphides, and then chloridized. These data have indicated generally that optimum temperatures for the separation of chlorides of Ni and Cu are between 600° and 700° C. (2) In chlorination with Cl diluted with air a certain proportion of chlorides is converted into oxides, whose quantity increases with rising temperatures. (3) Systems comprising various combinations of Cu, Ni and Fe chlorides in aqueous solutions were investigated in order to obtain data on solubilities at various temperatures, from which a procedure was worked out for separating the chlorides of Ni and Cu by crystallization. BND (1e)

Amalgamation Problems. IVOR BASSETT. *Can. Mining J.*, Vol. 58, Mar. 1937, pp. 121-122. A Western Ontario ore has the free Au associated with sulphides. The blanket concentration and amalgamation yield very little Au. The free Au in the mill discharge was much less tarnished than that in the classifier overflow. The grinding circuit was changed to permit the ball mill discharge to run over the blankets before going to the classifier. The ball charge was reduced and the Hg added increased in amount. The addition of Na_2PbO_2 to the Hg prevents the formation of soluble sulphides which had caused the tarnishing effect. WHB (1e)

Mill Expansion at Cariboo Gold Quartz. RUSSELL SPRY & J. D. BOULDING. *Trans. Can. Inst. Mining Met.*, Vol. 39, Aug. 1936, pp. 509-515; *Can. Mining Met. Bull.*, No. 292. The original flow sheet and 3 subsequent revisions for the cyanide plant of the Cariboo Gold Quartz Mining Co., Ltd., at Wells, B. C., are presented. Recovery in 1934-35 was 91-96%, average 93.8%, on mill feed carrying about 0.4 oz. Au/ton. AHE (1e)

2. ORE REDUCTION

A. H. EMERY, SECTION EDITOR

Contributions to the Data on Theoretical Metallurgy. V.—Heats of Fusion of Inorganic Substances. K. K. KELLEY. *U. S. Bur. Mines Bull.* No. 393, 1936, 166 pp. Heat-of-fusion values of inorganic substances from available freezing-point data of binary systems are presented and discussed, together with the methods of calculation. **VI.—A Revision of the Entropies of Inorganic Substances—1935.** IBID. *U. S. Bur. Mines Bull.* No. 394, 1936, 55 pp. Previous work is brought up to date on the basis of new determinations of low-temperature specific heats and advances in the realms of spectroscopy applicable to the determination of thermodynamic properties. Data are presented tabularly and discussed. For abstracts of previous installments see *Metals* and Alloys, Vol. 4, Mar. 1933, p. MA 83; Vol. 5, Dec. 1934, p. MA 555; Vol. 6, Dec. 1935, p. MA 481L/2; Vol. 7, Mar. 1936, p. MA 153L/8. AHE (2)

2a. Non-Ferrous

Reduction of Chromium Oxides. I. YA. GRANAT. *Metallurg,* Vol. 11, Oct. 1936, pp. 35-41. In Russian. Dry H_2 was passed at the rate 1-1.5 cc./min. for 50 hrs. through Cr_2O_3 contained in a special apparatus (described) at 1000°, 1100°, 1400° and 1500° C. Water produced was absorbed in P_2O_5 tubes. Cr_2O_3 is reduced, first to CrO and then to Cr. Dissociation pressure obtained at 1373° C. was $10^{-18.153}$ atm. (2a)

Electrolytic Production of Magnesium-zinc alloys. V. M. GUSKOV & KH. L. STRELETS. *Metallurg,* Vol. 11, Oct. 1936, pp. 18-26. In Russian. Mg was reduced on the Zn cathode. Solubility of metallic Zn in carnallite between 565° and 746° C. varied from 0.19 to 0.40 gm./Zn 100 gms. of carnallite. With concentration of Mg in Zn below 30%, temperature has little effect on current efficiency; at 80-95% Mg, maximum efficiency was 90% at 650-680° C. Optimum current efficiency, 91.75% was recorded with current density of 110-120 amps./dm.^{2}. Mg concentration up to 90% has practically no effect on current efficiency at 660-680° C. but a higher Mg content reduces it by 5-10%. CaF_2 addition does not increase the efficiency. (2a)

Electrometallurgical Studies on the Treatment of Alunite. R. G. KNICKERBOCKER & J. KOSTER. *Progress Reports—Metallurgical Division. 13. Electrometallurgical Investigations. U. S. Bureau of Mines, Report of Investigations,* No. 3322, Oct. 1936, pages 39-64. SiO_2 in alunite is one of the most detrimental factors to the successful use of alunite for Al manufacture. It is difficult to remove SO_3 from alunite by simple heating at practical calcining temperatures. No changes occur upon digestion of alunite with saturated steam at pressures up to 200 lbs./sq. in. At 200 lbs. and in the presence of K_2SO_4 and H_2SO_4 normal K alum or dehydrated K alum together with a SiO_2-Al_2O_3 gel is formed. Digestion of alunite in the presence of K_2SO_4 and H_2SO_4 at atmospheric pressures causes conversion to K alum and a zeolite. Fusion of high-grade alunite with borax glass produces a 2-phase system consisting of a vitreous slag and the high-temperature modification of K_2SO_4; no such separation occurred with high-SiO_2 alunite. Treatment of high-SiO_2 alunite at 500-625° with Cl and C volatilizes 90% of the Al_2O_3; K_2O is rendered water-soluble and can be leached from the residue and fume. SiO_2 can be volatilized from alunite by treatment with S-containing materials under reducing conditions at 1200-1500°. In an arc furnace, considerable Al_2O_3 is volatilized along with the SiO_2 when treating alunite with pyrite and C. The resistance-furnace treatment of high-SiO_2 alunite at about 1500° gives a volatile SiO_2 fume containing very small amounts of Al_2O_3. AHE (2a)

Problem of Slag in Making Ferro-manganese (Le Problème du Laitier dans la Fabrication du Ferro-manganèse) AGNAN ESME. *J. Four. Elec.,* Vol. 46, Feb. 1937, p. 50. To keep Mn losses at a minimum, as little slag as possible should be used and kept at minimum MnO content. Best results are to be expected with a slag: 22-25% SiO_2, 17-20% Al_2O_3, 48-50% CaO + MgO + BaO. JDG (2a)

The Rhokana Electrolytic Copper Refinery. ARCHER E. WHEELER & HENRY Y. EAGLE. *Bull. Inst. Mining Met.* No. 388, Jan. 1937, pp. 41-43. Discussion. See *Metals and Alloys,* Vol. 7, Aug. 1936, p. MA 396R/4. AHE (2a)

Roasting Reactions with Arsenides, Especially Those of Copper (Röstreaktionen bei Arseneiden, insbesondere des Kupfers) W. SAVELSBERG. *Metall und Erz,* Vol. 33, July 1936, pages 379-388. The importance of roasting in the treatment of As- and S-bearing metals is outlined. The reaction between As_2O_3 and Cu, Ni, Ag or Pt is reversible and under certain conditions may produce stable arsenates, often in combination with the Cu, Ni, Ag or Pt. The formation of arsenates may be prevented by roasting the ore in SO_2 rather than air; arsenites are formed, permitting removal of over 90% of the contaminating As. FPP (2a)

2b. Ferrous

Reducing Iron in a Drum Furnace (Eisengewinnung im Trammelofen) F. EULENSTEIN & A. KRUS. *Stahl u. Eisen,* Vol. 57, Jan. 7, 1937, pp. 6-11. Pyrite ore roasted in a Dwight-Lloyd roaster is mixed with lime and coal and charged into a drum furnace heated first with powdered coal and later with gas. Pig Fe of about the following composition is obtained: 4.4 to 4.8% C; 0.015% Si; 0.2 to 0.4% Mn; 0.01 to 0.03% P; less than 0.01% S. SE (2b)

The Production and Properties of Steel Made from Carbonyl Iron (Herstellung und Eigenschaften von Stahl aus Karbonyleisen) E. K. OFFERMANN, H. BUCHHOLTZ & E. H. SCHULZ. *Stahl u. Eisen,* Vol. 56, Sept. 17, 1936, pp. 1132-1138. In English and German. *See Metals and Alloys,* Vol. 8, Mar. 1937, p. MA 172L/2. Se (2b)

Reduction of Iron Oxides by Carbon in Blast Furnace Smelting. M. M. LEIBOVICH. *Metallurg,* Vol. 11, Oct. 1936, pp. 48-60. In Russian. Reactions leading to formation of metal and CO are reviewed from literature data. (2b)

Composition and Properties of Primary Blast Furnace Slags. M. YA. OSTROUKHOV. *Metallurg,* Vol. 11, Oct. 1936, pp. 61-72. In Russian. Primary blast furnace slags are the components formed in lumps of ore before the action of flux additions. Literature on the subject is comprehensively surveyed. The composition of these slags is claimed to depend on the sintering action taking place before slags are melted. A series of sintering experiments on SiO_2-CaO-Al_2O_3 was conducted and is presented on a ternary diagram. The data indicate the pronounced influence of the mineralogical nature of the components; temperatures obtained for given systems were usually lower than those reported by Rankin *et al.* Addition of Na_2O and MgO to the above ternary system reduced sintering temperatures. (2b)

Raw Coal in Blast Furnaces. W. T. ALLAN. *Metals Technology,* Jan. 1937, *Am. Inst. Mining & Metallurgical Engrs., Tech. Pub.* No. 764, 10 pages. Raw coal is still used in some Scottish furnaces for the production of high-quality foundry pig. The quality of Fe so made differs from that from coke-fired furnaces. Tar condenses on the ore as it travels through the furnace, coke is formed from this tar, the coke impregnates the ore to some extent. With the coal now available, a small amount of coke must be used. The operation of a small furnace with raw coal is discussed. JLG (2b)

The Reduction of Iron Ore Using Higher Pressure (Die Reduktion von Eisenerz unter Anwendung höherer Drücke) E. DIEPSCHLAG. *Arch. Eisenhüttenw.,* Vol. 10, Nov. 1936, pp. 179-181. Original research. At pressures up to 3 atmos. the increase in rate of reduction of Fe_2O_3 with H_2 and CO was greater than at higher pressures. SE (2b)

Use of Manganese Ore in Open-hearth Steel. E. BILLER (Ukrainian Inst. Metals) *Stal,* Vol. 6, Mar. 1936, pp. 11-17. In Russian. Practical. Consumption of FeMn at 6 South Russian works was reduced to about 2 lbs./ton by use of Mn ores. HWR (2b)

Rimming Copper Steel Produced at the Frunze Plant. P. MIKHAILOV-MIKHEEV & P. IVANOVA. *Stal,* Vol. 6, Mar. 1936, pp. 62-71. In Russian. Practical. Cu-bearing pig Fe is obtained by smelting pyrite cinders in a blast furnace. The open-hearth steel made from the pig contained 0.09-0.16% C, 0.39-0.47% Mn, 0.036-0.089% S, 0.025-0.046% P, and 0.34-0.084% Cu and had good chemical and mechanical properties. HWR (2b)

3. MELTING, REFINING AND CASTING

Elongated ("columnar") Crystals in Stearine Ingots (Strålkristaller i stearingöt) C. GEORG CARLSSON & AXEL HULTGREN. *Jernkontorets Ann.*, Vol. 120, Sept. 1936, pp. 577-586. Solidification structures of stearine ingots were studied in etched section. Pure benzol to which was added a soluble black aniline dye was used for etching. A surface zone of elongated crystals similar to that found in steel ingots was observed, but the crystals differ in having curved stems and branches. The directional deviation upwards from the normal to the isothermal as found in steel ingots was also observed. According to a hypothesis advanced by Phragmen, the deviation should be caused by a downward convection current in the molten steel in front of the growing crystals. To test this hypothesis a series of small stearine ingots was allowed to solidify while a continuous stream of molten stearine was flowing upwards through the mould. In all cases the stems of the elongated crystals deviated in a direction opposite to the direction of flow. HCD (3)

Foundry Sand Testing Problems at High Temperatures. P. E. KYLE. *Trans. Am. Foundrymen's Assoc.*, Vol. 7, Dec. 1936, pp. 401-413. Review. Published data on the properties of foundry sands at elevated temperatures are reviewed, plotted, and discussed. The drastic temperature effects are shown to be confined to a comparatively thin layer of sand adjacent to the casting. Test methods for refractoriness, expansion and contraction, permeability, and compressive strength are described, and some typical data discussed. Future lines of research are suggested. CMS (3)

Mould and Core Protective Facings at Atmospheric and Elevated Temperatures. R. F. HUDSON. *Foundry Trade J.*, Vol. 55, Dec. 3, 1936, pp. 427-431. General review. The facing materials may be divided into two main groups: (1) carbonaceous facings (plumbago, lamp black, charcoal, coke dust, etc.) and (2) mineral facings (silica flour, zirconia, soapstone). Silica flour is usually sold in a very pure state, and is very refractory. Unfortunately it is obtained from various sources and each different source of supply cannot be guaranteed to behave similarly. Silica flour may be derived from tripoli powder, kieselgühr, ground quartz or superfine sand. For dry-sand work the facing is applied wet in the form of a wash. An ideal wash should have equal expansion as the molding sand. For cast-iron and non-ferrous work, graphite gives a better finish to the casting than any other material in common use. Silica flour seems to be the best material for steel washes when used correctly. The thinnest possible application of the wash is recommended. AIK (3)

Finished Castings (Fertigguss) M. STORCH (Siemens-Schuckertwerks A.G.) *Z. Ver deut. Ing.*, Vol. 87, Jan. 30, 1937, pp. 119-125. The conditions required for the production of clean castings of correct dimensions without subsequent machining are discussed. Materials, equipment and properties, and economy of the method are dealt with. The following casting temperature ranges are recommended:

Pb alloys	260°-300° C.
Sn alloys	280°-330° C.
Zn alloys	400°-480° C.
Al alloys	650°-750° C.
Mg alloys	650°-700° C.
Cu alloys	870°-940° C.

Tables of mechanical properties for Pb, Sn, Zn and light metal alloys are added. Forms of dies, obtainable accuracies and corrosion resistance are discussed. Ha (3)

Pattern-Making for Moulding. H. BRITTAIN. *Foundry Trade J.*, Vol. 55, Nov. 19, 1936, pp. 386-388. Practical. Skeleton patterns, ring segments, patterns for large numbers and machine molding are discussed, with 8 photographs. AIK (3)

Capillarity as a Factor in Foundry Practice. ALBERT M. PORTEVIN & PAUL G. BASTIEN. *Metal Ind., London*, Vol. 48, June 19, 1936, pp. 683-687; June 26, 1936, pp. 716-720. See *Metals and Alloys*, Vol. 7, Nov. 1936, p. MA 526L/7. HBG (3)

Distillation of Metals in Vacuum. N. D. TOMASHOV. *Metallurg*, Vol. 11, Nov. 1936, pp. 109-117. In Russian. An improved apparatus for vacuum distillation at the maximum temperature of 1000° C. is described, with structural details. Rate of condensation is controlled by insertion of Cu rods into the pipe on which metals are deposited. (3)

Study of Equilibrium between Metals and Slags (Contribution à l'Étude des Équilibres entre Métaux et Laitiers) RENÉ PERRIN & JEAN LAMBERTON. *Compt. Rend.*, Vol. 204, Jan. 25, 1937, pp. 267-269. General discussion. The variation of the constant of equilibrium obtained from the law of mass action for the metal-slag reaction is influenced by the vapor pressures of the metal and its oxide. The relative volatility of the metal or its oxide is an important factor in the formation of slag from the metal. FHC (3)

Use of Virgin Cast Iron for Quality Castings Production. N. I. BLINOV & G. A. PISARENKO. *Liteinoe Delo*, Vol. 7, No. 10, 1936, pages 8-15. In Russian. The feasibility of using a rotary furnace for superheating and adjusting the composition of the blast furnace product to make it suitable for direct production of quality castings is demonstrated. Detailed description of the furnace and practice used is given. (3)

Optimum Utilization of Blowing Machines in Blast Furnace Practice. S. N. ALEKSANDROV. *Metallurg*, Vol. 11, July 1936, pages 21-26. In Russian. The ratio between cubic capacity of the hearths and useful cross-section of tuyeres varies considerably in Russian blast furnace plants, even in the same plant. This places a heavy burden on blowing machines. Means for standardization and improvement suggested. (3)

Operation of Large Cupolas. I. S. MAKSIMOV. *Liteinoe Delo*, Vol. 7, No. 10, 1936, pages 26-33. In Russian. Describes troubles encountered in operating 25 tons/hr. cupolas and mentions methods of eliminating obvious troubles. (3)

Casting Flour and Oil Mill Rolls Centrifugally. N. I. FEIGIN. *Liteinoe Delo*, Vol. 7, No. 10, 1936, pages 40-43. In Russian. Composition and structures obtained on the basis of experimental work with a small casting machine are described. 39 references. (3)

Electric Melting Furnaces (Les Fours Electrique de Fusion) M. FOURMENT. *Usine*, Vol. 44, Nov. 5, 1936, page 29. Brief review of present types and their operating principles. Ha (3)

3a. Non-Ferrous

G. L. CRAIG, SECTION EDITOR

Recovery of Battery Scrap and Residues by Metallurgical Process. EDMUND R. THEWS. *Can. Chem. Met.*, Vol. 21, Jan. 1937, pp. 17-19. General discussion. Factors to be considered in remelting and smelting of accumulator scrap and residues in Pb refining furnaces are: (1) metallic constituents should be separated as completely as possible, (2) residues should be charged through a coarse-meshed sieve and the coarse material smelted in the Pb refining furnace, if possible, (3) the residues must be freed from all non-metallic impurities such as wooden separators, plugs, rubber parts, etc., and (4) all Sb slag should be removed before charging the oxides into the furnace, and blast must be stopped during charging. Battery residues can be advantageously recovered in reverberatory furnaces of 2-5 tons capacity. Where Pb blast furnaces are available the battery residues may be melted therein; residues do not interfere with the blast furnace reactions unless they contain too much acid, when drying, washing or neutralizing with lime is indicated. The reverberatory furnace offers certain advantages: no clogging and freezing of tuyeres and hearth sections, no formation of accretions, ease of control during the melting and smelting processes, and ease of correcting errors committed in mixing and charging the raw material. A disadvantage is that reverberatory slags usually are rich in Pb and require a final treatment in the blast furnace. These slags can be charged to other blast furnace mixtures for satisfactory smelting. Blast furnace advantages are: greater capacity, and greater ease in developing blast furnace processes technically and commercially superior to reverberatory furnace methods. WHB (3a)

Founding of Aluminum Bronze. J. E. CROWN. *Trans. Am. Foundrymen's Assoc.*, Vol. 7, Dec. 1936, pp. 359-366. Al bronzes are one of the most difficult of the non-ferrous alloys to produce. Composition, melting practice, and molding methods are discussed. Castings of intricate design should be specified only after consultation between designer and foundryman. Test values are given on 13 alloy compositions, with 86-90% Cu, 9-10% Al, and 1-4% Fe. CMS (3a)

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Manganese Bronze—A Correlated Abstract. F. R. HENSEL. *Trans. Am. Foundrymen's Assoc.*, Vol. 8, Feb. 1937, pp. 457-478.

1 A condensed review of the principal factors in the production of Mn bronze castings is presented. The items covered are chemical composition, melting procedure, control of composition, furnaces, removal of impurities in scrap, casting of ingots and chill castings, temperature measurements, sand casting, gating, feeding, pouring, Zn equivalent, effect of hardening elements on brass, physical properties, microstructure, effects of impurities, fields of application, effect of temperature, embrittlement and heat treatment. 68 references. CEJ (3a)

2 **Pressure-casting Process for the Production of Thin Linings of Railway Vehicle Bearings (Druck-Giessverfahren für die Herstellung dünner Ausgüsse von Eisenbahn-Fahrzeuglagern)** S. BEILFUSS. *Z. Ver. deut. Ing.*, Vol. 80, Dec. 5, 1936, pp. 1475-1477.

3 Practical. A method for lining bearing bushings is described by which the electrically melted lining metal is pressed under high gas pressure into the bushing. Sn- or Pb-rich alloys can be used without preliminary tinning of the bushings or demixing in the Pb-rich alloys. The linings can be made very thin so that the method is most economical. Ha (3a)

Sand Castings of Copper-Silicon Alloys. H. A. BEDWORTH & V. P. WEAVER. *Foundry Trade J.*, Vol. 55, Nov. 19, 1936, pp. 391-392. *See Metals and Alloys*, Vol. 7, Dec. 1936, p. MA 575L/1. AIK (3a)

4 **Recommendations for Two Leaded Gunmetals.** *Foundry Trade J.*, Vol. 54, June 11, 1936, pp. 456, 457, 460. See *Metals and Alloys*, Vol. 7, Nov. 1936, p. MA 526R/1. AIK (3a)

Recent Progress in Light Alloy Casting (Les Récents Progrès en Fonderie d'Alliages Légers) L. MONTUPET. *Bulletin de l'Association Technique de Fonderie*, Vol. 10, July 1936, pages 269-271. A. T. F. committee report presented in June 1936. Al alloys with Cu and Ti, such as A. P. 33 and W 41 with proper heat treating yield products with tensile strength of around 45,000 lbs./in.^{2} Methods for casting Al and Mg alloys are also given.

5 WHS (3a)

Application of the Brackelsberg Furnace to Copper Smelting (Die Anwendung des Brackelsberg-Ofens in Kupferverhüttungen) FRITZ MAYER. *Metall und Erz*, Vol. 33, June 2, 1936, pages 325-329. Evolution of the Brackelsberg furnace, and its application to copper refining at the Oranienburg plant of C. W. Kayser & Co., are described. FPP (3a)

6 **Centrifugal Casting of Non-ferrous Metals (Schleuderguss von Nichteisenmetallen)** A. H. LUDWIG. *Zeitschrift Verein deutscher Ingenieure*, Vol. 80, Oct. 3, 1936, pages 1227-1228. Development of centrifugal casting is briefly reviewed and the forces and stresses in mold and material to be cast discussed. When casting bronze centrifugally the rotating velocity of the mold can be:

	4 cm. mold diam.	12 cm. mold diam.
For horizontal casting	1400-1500 r.p.m.	500-550 r.p.m.
For vertical casting	2000-2400 r.p.m.	750-800 r.p.m.

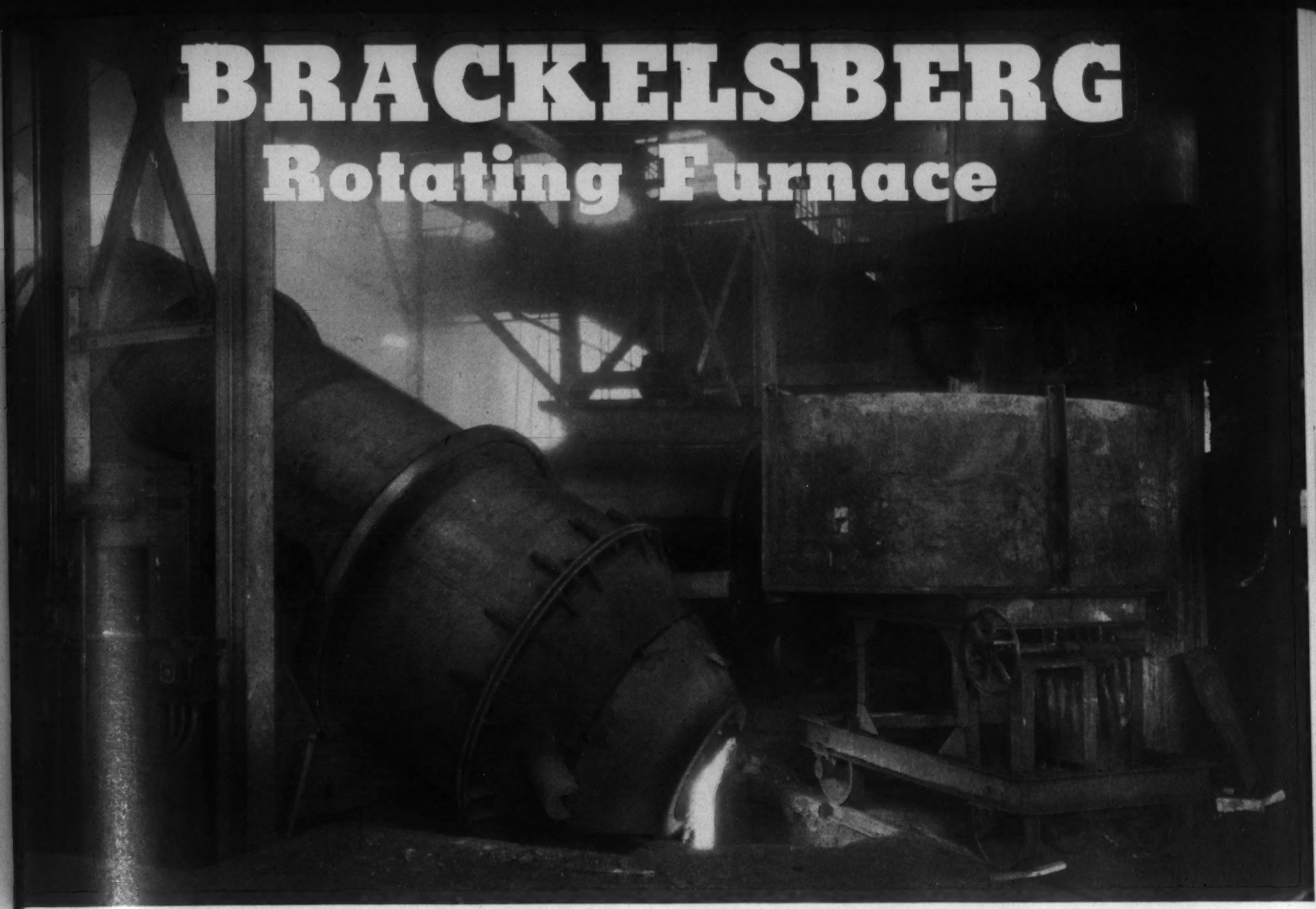
7 Centrifugal casting produces a fine-grained, dense material; impurities and oxides are separated at the inside as they are lighter than the metal; the tensile strength is usually 30-50% better than that of metal cast conventionally. Wearing strength is so improved that in Sn-bronzes the Sn content, and in Ni-bronzes the Ni content can be reduced without reduction in mechanical properties. 4 references. See *Metals and Alloys*, Vol. 7, Jan. 1936, page MA2L/5. Ha (3a)

8 **The Melting of Platinum.** C. M. HOKE. *Metal Industry*, New York, Vol. 34, Nov. 1936, pages 433-435; Dec. 1936, pages 468-470. Melting small lots, cleaning and melting filings, difficulties caused by impurities and by the use of improper flame, imperfections (such as brittleness, warts, pits, and doubles), melting of large lots, Pt sponge and Pt alloys are discussed. Electric furnaces and O torches are both used for melting Pt. Crucibles made of CaO, ZrO_2 and Zr silicate are used. Graphite or C is not suitable for Pt work since a brittle carbide is formed. Quartz and alundum crucibles melt near the m.p. of pure Pt and are therefore unsuitable. CBJ (3a)

9

Report on Recommended Practices for Sand-Cast Magnesium Alloys. *Foundry Trade Journal*, Vol. 55, Sept. 10, 1936, pages 197-199 and 202. This report was presented at a session on Non--Ferrous Castings at the 1936 convention of the A. F. A. in Detroit in 1936. AIK (3a)

10 **In Africa They Have a Name for It.** JAMES FARRON. *Foundry*, Vol. 65, Mar. 1937, pp. 27, 86. Describes difficulties encountered by the author in casting an S-shaped, 2000-lb. pipe, cast in P-bronze, at a foundry in Johannesburg, S. Africa. VSP (3a)



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• ***Why Lower Cost*** A number of factors account for the low cost of production. These include low-priced fuel (coal), a much larger percentage of scrap in the charge, low power consumption, reduced oxidation losses (1% or under), fewer defective castings, very low refractory cost, and better timing of operations to suit production requirements.

• ***Will the Brackelsberg Help You*** That is a question we should like to discuss. Let us tell you more about this interesting melting furnace. Every foundryman ought to investigate the money-saving possibilities of the Brackelsberg.

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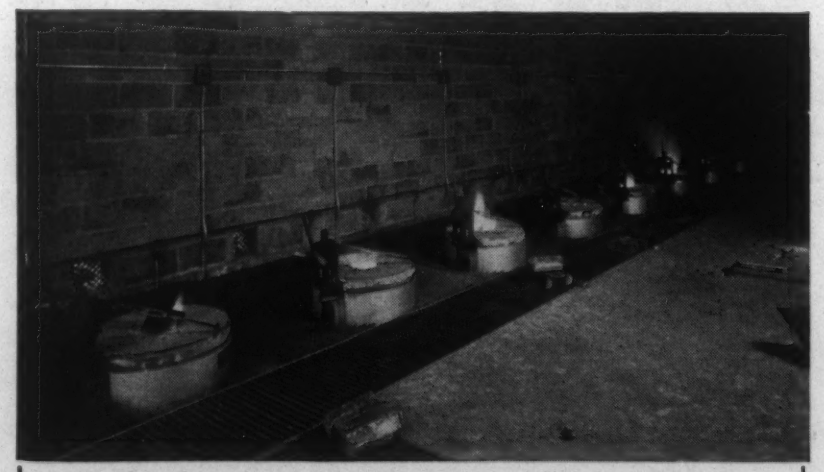
3b. Ferrous

C. H. HERTY, SECTION EDITOR

The Fluidity of Iron-carbon and other Iron Alloys. J. H. ANDREW, R. T. PERCIVAL & G. T. C. BOTTOMLEY. *Foundry Trade J.*, Vol. 55, Nov. 5, 1936, pp. 354, 355, and 362; Nov. 12, 1936, pp. 377-379. Section III. Second report of the Steel Castings Research Committee. Original research. At first, the method of measuring fluidity developed at the National Bureau of Standards was employed, but the steel froze at the entrance to the spiral and therefore the horngate was eventually discarded. Succeeding tests were top-poured at the outside of the spiral, with a blind reservoir beneath the plane of the spiral and directly under the down-gate, with a riser at the center of the spiral. In determination of fluidity-casting temperature relation the following systems were considered: Fe-C, Fe-P, Fe-Si containing 0.4% C, Fe-Mn containing 0.5% C, using a W-Mo thermocouple for measuring temperature. For each composition on the fluidity-temperature curves only two points were experimentally determined, the assumption being made that the position of the liquidus on the temperature axis for any particular alloy locates the point of zero fluidity. On this assumption, curves are plotted showing the relationship between fluidity and temperature for each composition. From these the fluidity of each alloy at 1600° C. was obtained and curves showing relationship between fluidity and composition at 1600° C. were constructed for different series of alloys. The addition of C to Fe increases the fluidity, the casting temperature being constant. This increase, however, is very slight over the peritectic range (0.07 to 0.71% C). With further increase of C there is a noticeable increase in fluidity up to the eutectic composition. To explain this apparent discrepancy, it was assumed that the temperature of zero fluidity occurs at the solidus on the equilibrium diagram. It appears that by using the solidus as the point of origin more precise information is obtained, and that where the liquidus-solidus range is a maximum, the fluidity is a minimum. In addition, in the Fe-C series two entirely separate systems have to be dealt with. As soon as the influence of peritectic range (0.70% C) is passed, a perfectly normal system occurs, wherein the fluidity of the alloy is inversely proportional to the liquidus-solidus range in the diagram. AIK (3b)

The Production of Dense Iron Castings. J. H. WILLIAMS. *Foundry Trade J.*, Vol. 55, Dec. 10, 1936, pp. 449-452; Discussion, Dec. 17, 1936, pp. 471-472. Very interesting up-to-date review plus original research. To possess a dense structure, the graphite
1 flakes must be small, nests of eutectic graphite should be absent, and the ground mass must be free from small cavities and segregates. Many of the differences in pig irons are due to presence of highly dispersed oxides and crystallites. In view of Piwowarsky's work on the influence of silica crystallites and oxide inclusions in promoting the formation of coarse graphite, it is probable that they are the chief cause of coarse graphitic crystallization in cast iron and the presence of unmelted residues of graphite is only of secondary importance. It is known that the addition of white
2 Fe to a charge may cause trouble unless suitable precautions are taken to eliminate the oxides. The presence of oxides may always be suspected when an Fe becomes sluggish. Eutectic graphite in the author's experience is more liable to occur during the solidification of hyper-eutectic Fe. Fe-Al is useful as a de-oxidizer. Compositional readjustment, control of P, steel scrap additions, pearlitic Fe, influence of cupola practice, Mn as scavenger, the composition of slags in cupola melting, etc., are discussed. AIK (3b)

3 **Some Factors Influencing the Production of Sound Castings.** E. W. WYNN & D. HOPE. *Foundry Trade J.*, Vol. 55, Nov. 12, 1936, pp. 373-376, 379. Discussion, page 371. Original research on cast Fe. The effect of Mn on graphite flake size, soundness, and surface finish was studied. There was a perceptible increase in length and thickness of the graphite flakes with an increase in Mn, but no increase in strength of the cast Fe; this may be due to the increased size of graphite. Discussion points out that (1) sometimes a glazed inclusion appears in the Fe; this is due to Si
4 and Mn. (2) Mn in higher proportions increases grain size, and in special castings, such as certain crusher rollers, high Mn contents are employed to give a very coarse grain and open surface which "bites" on to the softer materials to be crushed. In such cases the Mn content is generally 0.6% = 1%. Mn refines the pearlite, and (like Ni) increases hardenability. (3) The further the Fe recedes from the eutectic composition the lesser is the effect of the other elements. In Fe having a C content of 3%, a Mn content up to 0.7% may be used without causing serious difficulty
5 with respect to graphite size, but only with low C content can the Mn be increased to 1%. AIK (3b)



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The British Cast Iron Research Association. *Foundry Trade J.*, Vol. 55, Nov. 5, 1936, pp. 349, 350. Abstract of the 15th annual report. Reviewing status of the Association's investigation of the formation of graphite in cast iron. The process evolved for the refinement of graphite consists of an incorporation in the melt of a small amount of Ti and subsequent treatment of the melt with an oxidizing gas. It is suggested that graphite originates not from undissolved graphite nuclei as proposed in an earlier theory, but from non-metallic particles, particularly silicate inclusions. The Ti process refines graphite, probably by the formation, during the gas treatment, of a low-melting Ti slag, which envelopes the non-metallic particles already present. Because this envelope is fluid, the particles are prevented from exerting an inoculating action, thus permitting the metal to solidify in the supercooled state. The original coarse structure can be reproduced by treatment of the melt with H, which has a reducing action on the slag envelopes. AIK (3b)

Studies on the Viscosity of Open-hearth Slags (Untersuchungen über die Zähigkeit von Siemens-Martin-Schlacken) F. HARTMANN. *Arch. Eisenhüttenw.*, Vol. 10, Aug. 1936, pp. 45-52. Original research. The viscosity of open-hearth slags was studied by the Margules torsional method. There was no simple relation between viscosity and the changes in content of SiO_2, Al_2O_3, MnO, CaO, FeO in the slag during the course of the melt, so that the viscosity could not be predicted from the composition but had to be determined. Fluorspar lowered the viscosity and reduced the temperature range of the pasty stage between high and low viscosity. Sr decidedly lowered the viscosity especially in acid slags. Raising the Al_2O_3 content 10% did not lower the viscosity; the lowering in viscosity on adding Bauxite observed in practice is due to an increase in FeO. Increasing Fe_2O_3 and FeO caused first an increase in viscosity then a decrease. SE (3b)

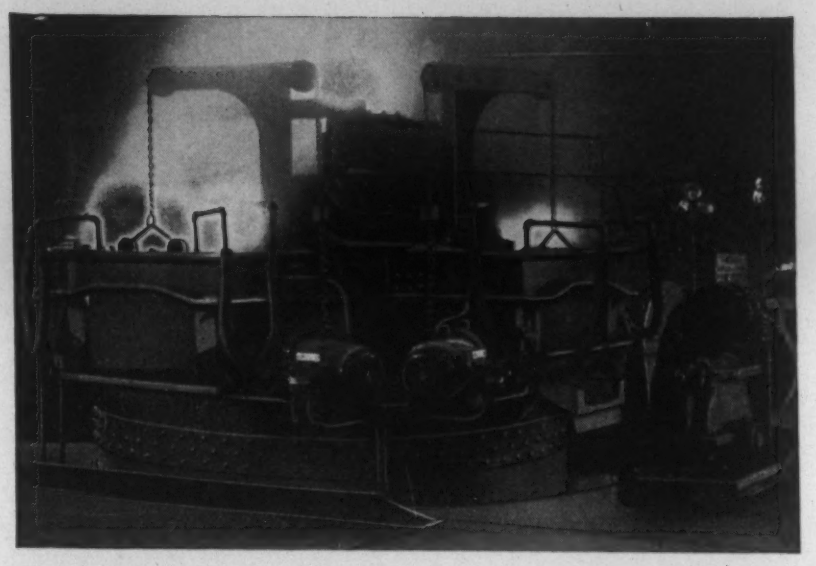
On the Fluidity of Lime-silicates, Lime-ferrites and Basic Open-hearth Slags at 1625° C. (Ueber den Flussigkeitsgrad von Kalksilikaten, Kalkferriten und basischen Siemens-Martin-Schlacken bis 1625°) K. ENDELL, G. HEIDTKAMP & L. HAX. *Arch. Eisenhüttenw.*, Sept. 1936, pp. 85-90. Original research. Viscosity-temperature curves of the systems $CaO\text{-}SiO_2$, $CaO\text{-}Fe_2O_3$, and the effect of increasing content of SiO_2 on lime-ferrite $CaO.Fe_2O_3$, were determined with a torsion viscosimeter. Slags with lowest CaO content had the lowest viscosity. The fluidity increased sharply as the temperature increased from 1450 to 1625° C. Open-hearth slags at these temperatures were about 10 times as fluid as blast furnace slags and lay between the high value of $CaO.SiO_2$ and the low value of $CaO.Fe_2O_3$. SE (3b)

The **Use of Ferro-alloys in the Foundry (L'Emploi des Ferro-Alliages en Fonderie)** P. F. VIANDON. *Bull. l'Association Tech. Fonderie*, Vol. 10, Sept. 1936, pp. 324-332. Methods of addition, composition and form of the alloys are all important considerations. Ca, Ca-Si, and Ca-Si-Al additions to low Si cast Fe gave gray fractures and high strength properties to the metal. The addition of oxidizing salts, such as $Na_2Cr_2O_7$ or Na_2CO_3 along with the Ca or its alloys gave more intense graphitization, desulphurization, and remarkably high strength for the metal. The better known alloys are discussed briefly and recommended compositions are given for special application. WHS (3b)

Use of Reduced Pressure in Steel Making. P. YA. AGEEV, S. V. DRICHEK & I. S. ROSENHAUSE. *Metallurg*, Vol. 11, Nov. 1936, pp. 53-57. In Russian. Induction furnace heats made under average vacuum of 25-35 mm. Hg using C steel as raw material furnished metal free from surface blowholes. Large reduction in C, Mn and Si content was attributed to the reduction of MgO of the crucibles by C of the metal. (3b)

Molding Sand in the Malleable Iron Foundry. H. W. DIETERT & FRANK VALTIER. *Trans. Am. Foundrymen's Assoc.*, Vol. 7, Dec. 1936, pp. 337-352. Samples of sand from 13 foundries and information concerning their use were secured. These sands were tested and the data showed various relations of sand properties to effects on castings produced. Synthetic sands are being used to a considerable extent; for smoothest casting surfaces, sands with lowest permeabilities are desired and an approximate relation may be established between permeability and smoothness; pyrometric control of metal temperature is now general in malleable foundries. CEJ (3b)

Point Liquation in Alloy Steels. A. S. JHURAVLEV. *Metallurg*, Vol. 11, Nov. 1936, pp. 87-89. In Russian. Point liquation, shown in deep etching as scattered dots, might be results of localized S or P segregations or a lack of Fe atoms required for building normal space lattice (N. T. Gudtsov' theory). Six acid open-hearth alloy steels were cast in ingots of different weights in order to determine the influence of alloying elements on point liquation. Some qualitative trends were reported. (3b)



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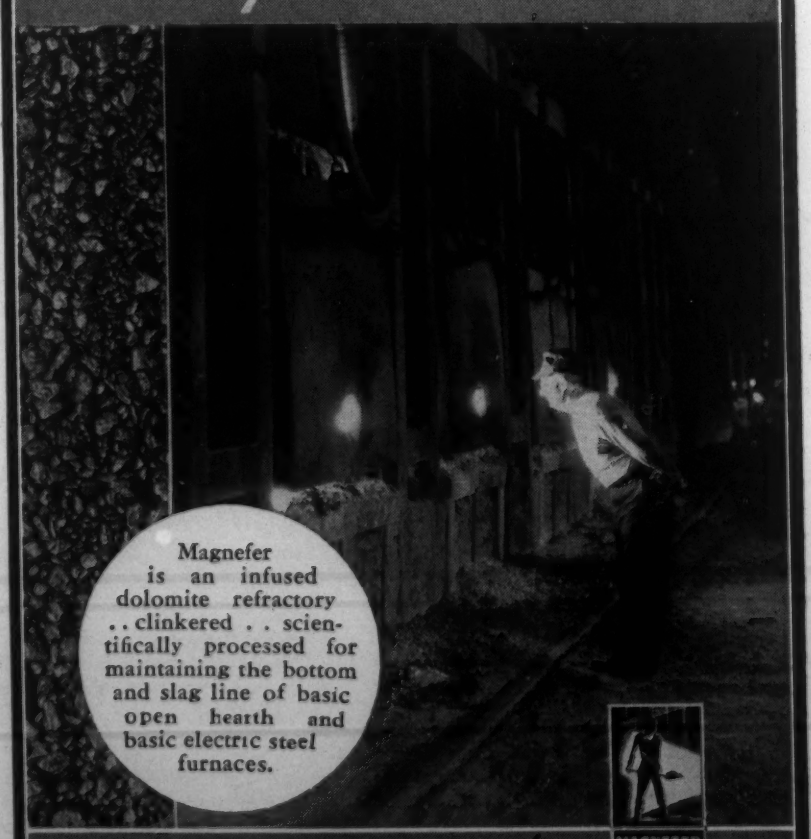
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Determination of Melting Velocities (Zur Bestimmung der Schmelzgeschwindigkeiten) G. TAMMAN & H. HARTMANN. *Z. anorg. allgem. Chem.,* Vol. 230, Dec. 19, 1936, pp. 53-64. **The Rate of Melting of Iron in Contact with Carbon (Die Schmelzgeschwindigkeit des Eisens in Beruhrung mit Kohlenstoff)** IBID. *Arch. Eisenhüttenw.,* Vol. 10, Nov. 1936, pp. 223-224. Original research. The melting velocity of a metal may be determined directly by the length change of a vertical specimen rod which has its end face pressed in direct contact with the end of a similar copper rod, through which heat is conducted into the specimen in amount proportional to the thermal gradient in the copper rod. The melting velocity was shown to be proportional to the heat influx rate as demanded by theory. The method was modified to study the melting of eutectics (Pb-Sn, Ag-Cu, Cd-Zn, and acetanilid-dinitrophenol) by using pairs of rods which were binary eutectic components in contact at temperatures between the melting point of the more fusible component and the eutectic temperature. Where the thermal conductivities of the components were the same, the analysis of the molten layer between the rods was that to be expected from the binary diagram. With sufficient interface pressure and rapid removal of molten metal, the melting velocities were found to be proportional to the difference between the experimental temperature and the eutectic temperature. A study was also made of the pair Fe-C, but the melting velocities were found to be dependent on the nature of the carbon rod, and the analysis of the molten film was that of the equilibrium austenite instead of the ledeburite eutectic. HFK + SE (3b)

An Improved Method for Preparing Cast Iron Transverse Test Bars. A. I. KRYNITSKY & C. M. SAEGER, JR. *Foundry Trade J.,* Vol. 55, Dec. 24, 1936, pp. 485-488. See *Metals and Alloys,* Vol. 7, Sept. 1936, p. MA 457L/4. AIK (3b)

Pit Molding (Le Moulage en Terre, Caractères et Applications) H. DUBOIS. *Bull. Association Tech. Fonderie,* Vol. 10, Aug. 1936, pp. 287-297. Detailed description of pit molding by means of bricks. The uses and advantages of the method are considered. WHS (3b)

A New Process of Smelting Foundry Pig-iron. MAX PASCHKE & EUGEN PEETZ. *Foundry Trade J.,* Vol. 55, Dec. 10, 1936, pp. 454-457. See *Metals and Alloys,* Vol. 8, Apr. 1937, p. MA 204L/7. AIK (3b)

Structure of Rimmed-steel Ingots. T. S. WASHBURN & J. H. NEAD. *Metals Technology,* Jan. 1937, *American Institute Mining & Metallurgical Engineers, Technical Publication* No. 779, 20 pages. Rimmed-steel ingots were split by drilling and blasting. These split ingots allow observations on thickness of skin and location and size of both primary and secondary blow holes. Photographs are shown of thick-skinned, thin-skinned, and normal rimmed ingots. Ingots capped normally and capped late are also shown. Etched sections of sheet bars rolled from ingots capped at different times are shown. Some of the ingots were killed with Al after different times of rimming. In the killed ingots thickness of the rimmed zone decreased with decreased rimming time, which was considered proof that the rimmed zone in normal ingots is formed only while the steel is actually rimming, and that, after capping the core-type of structure is formed. Reactions that occur during rimming and the influence of different factors on rimming action are discussed. JLG (3b)

The Mechanism of Ingot Segregation (Ueber den Mechanismus der Blockseigerung) J. VERŐ. *Royal Hungarian Palatine Joseph University of Technical and Economic Sciences, Faculty of Mining, Metallurgy and Forestry of Sopron,* Vol. 8, 1936, pages 194-218. Summary in English. Investigation of segregation in ingots showed that it can be caused by two opposing motions in the melt. Segregation occurs when the solid differs in composition from the average composition of the melt. If the formation of primary crystals takes place with reduction in volume a flow of the melt from inward to outward occurs and thus an inverse segregation; if the volume increases the flow is from the outside towards the interior and normal segregation occurs. The forces producing the flow are believed to result from small channels between the formed crystals. Alloys showing inverse segregation characteristically contract during formation of the primary crystals. 18 references. Ha (3b)

Studies on Heat Loss of Pig Iron between Blast Furnace and Mixer (Untersuchungen über den Wärmeverlust des Roheisens auf dem Wege vom Hochofenwerk zum Mischer) K. FRÖLICH. *Stahl und Eisen,* Vol. 56, Dec. 3, 1936, pages 1473-1479. Pig Fe temperatures were measured with thermocouples and optically by sighting through graphite tubes. The main source of heat loss was the cooling of empty pig ladles. Heat losses could be lowered by shortening the time of transfer and reducing the number of ladles. SE (3b)

Improvement in Basic Open-Hearth Process to Approach Acid Operation. I. S. KAPTIUG, S. I. SMOLENSKI & S. I. SAKHIN. *Metallurg,* Vol. 11, Nov. 1936, pp. 37-46. In Russian. Plant scale experiments were made to demonstrate the advantages of slower decarburization in the finishing stages of heats. After removal of the first highly oxidizing slag, another slag was introduced with acidity varying between 2 and 2.4 and the heat almost fully deoxidized by different means. Steels so produced are stated to have better physical properties, though no figures are given. Detailed descriptions of the practice followed is given. (3b)

Stable Cast Iron for Ingot Molds. P. A. KARKHANIN. *Metallurg,* Vol. 11, Oct. 1936, pp. 94-97. In Russian. Average life of ingot molds employed at the plant in which this investigation was conducted is 25 teemings for 4-ton molds. Their composition is: 3.3% total C, 2.5 graphitic C, 1.5 Si, 0.5 Mn. Repeated heating and cooling of bars of this Fe and two experimental irons containing 3.38% total C, 1.48 graphitic C, 2.3 Si, 1.34 Mn, 0.86 Cr, 0.45 Ni, and 2.34% total C, 2.34 graphitic C, 5.73 Si, 0.58 Mn showed that Cr-bearing Fe was the best as far as oxidation, growth and warpage were concerned. (3b)

Studies on the Chemistry of the Basic Open-hearth Process (Untersuchungen über die Chemie der basischen Stahlerzeugungsnerfahren) H. SCHENCK & W. RIESS. *Arch. Eisenhüttenw.,* Vol. 9, June 1936, pp. 589-600. Original research. The partition of FeO between bath and slag in basic open-hearth practice was determined by calculation and by chemical analysis. The calculations were based on the relationships between the total composition of the slags in the open hearth heats studied and the content of free FeO, MnO, CaO, and SiO_2 in the slags as affected by temperature; also on the equilibria of the P and Mn reactions. The calculated values agreed fairly well with the actual analyses. SE (3b)

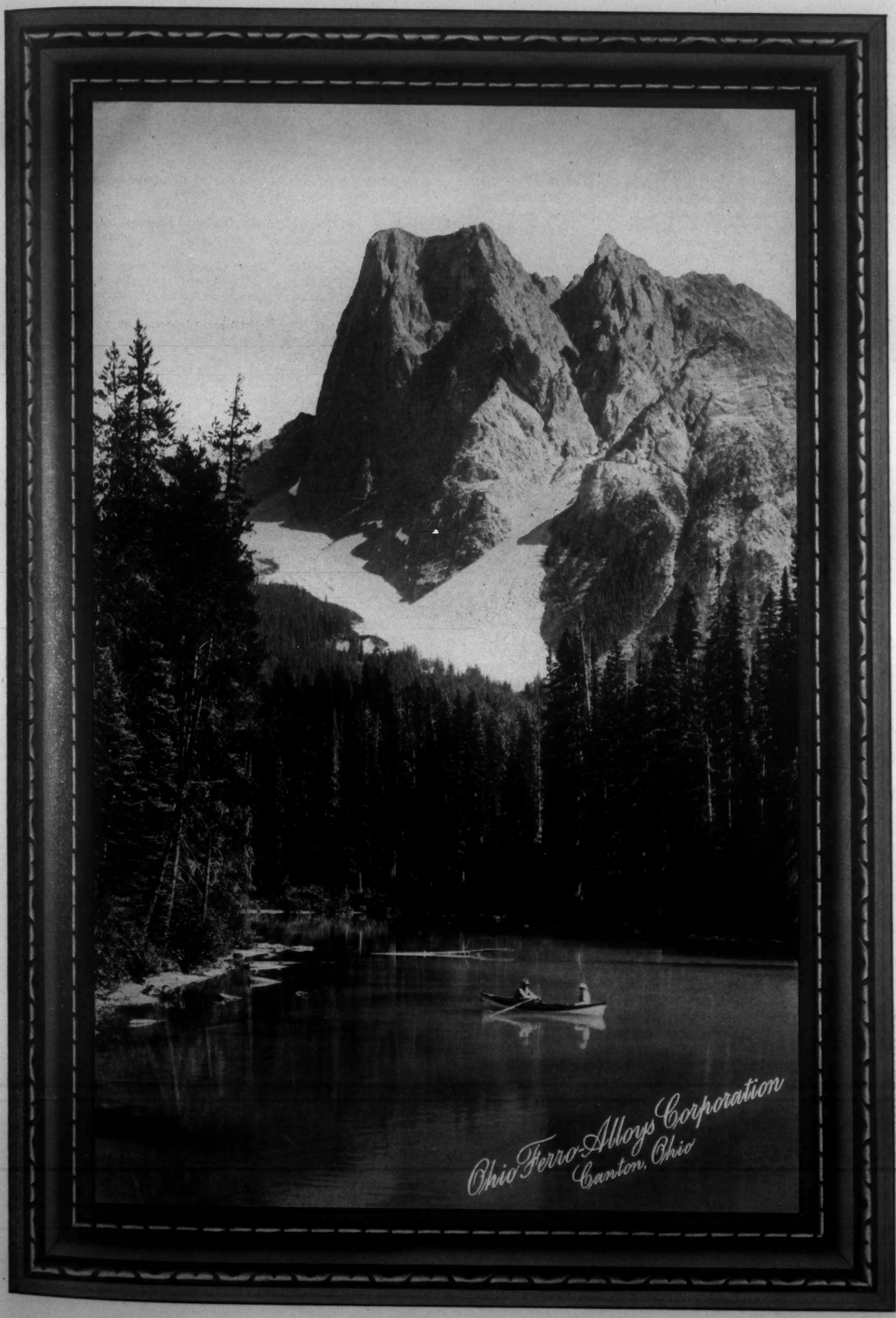
Second Report of the Steel Castings Research Committee. *Iron & Steel Institute,* Special Report No. 15, Sept. 1936, 117 pages. Section I is an introduction. Section II, by R. H. GREAVES, discusses some properties of steel that affect quality of castings. Change in volume on cooling, and fluidity of the molten steel are considered. Section III, by J. H. ANDREW, R. T. PERCIVAL & G. T. C. BOTTOMLEY, gives the results of determinations of fluidity of liquid steel. A spiral mold was found most suitable for measuring fluidity. Data on the influence of C, Mn, P and Si on fluidity are given. In amounts found in cast steel all increase fluidity. Section IV, by H. F. HALL, gives results of high-temperature tensile tests on steel cooling in the mold. Section V, by W. J. REES, outlines program of sub-committee on molding materials. Section VI, by V. E. PULLIN, discusses the present development of radiography for study and inspection of steel castings. Appendix I is an annotated biblography of 60 references on fluidity and viscosity of metals. Appendix II, by H. W. HATFIELD, gives brief recommendations for calibration and use of optical pyrometer. JLG (3b)

Intricate Thin-walled Steel Castings. R. HUNTER & I. MCARTHUR. *Mechanical World & Engineering Record,* Vol. 99, June 26, 1936, pages 635-638. Full account of recent paper before 33rd Annual Conference of the Institute of British Foundrymen. A practical example is described at length. WH (3b)

Copper and Copper-manganese Gray Cast Iron. L. W. EASTWOOD, A. E. BOUSU & C. T. EDDY. *Foundry Trade Journal,* Vol. 55, Sept. 24, 1936, pages 234-238, 240. Extended abstract of paper presented at cast Fe session of the 1936 convention of the A. F. A. AIK (3b)

Physico-chemical Analysis of the System Iron-oxygen. Re-investigation using the New Semi-permeable Membrane Method. E. V. BRIZKE, A. F. KAPUSTINSKIY & T. I. SHASHINA. *Izvestia Sektora Fiziko-Khimicheskogo Analiza,* Vol. 8, 1936, pages 141-149. In Russian. The equilibrium $FeO + H_2 = H_2O + Fe$ is directly investigated up to 1200° C. using the semi-permeable membrane method. The results of the determination of K_p are in agreement with those of Kings and Kempkens. An empirical equation for calculating the dissociation pressure of FeO is given. NA (3b)

Surface Quality and Surface Properties of Cast Iron (Oberflächenbeschaffenheit und Oberflächeneigenschaften von Gusseisen) E. DIEPSCHLAG. *Giesserei,* Vol. 23, Sept. 11, 1936, pages 466-471. The importance of surface appearance and the relation of surface quality to the properties of cast Fe are discussed. The extremely thin casting skin consists of 3 clearly distinguished zones. During pouring the skin absorbs O_2, which reacts with the mold walls to affect the appearance. Adhesion of mold sand is prevented by blacking or by casting in a neutral atmosphere. Bending strength increased with decreased surface roughness. Ha (3b)


Ohio Ferro-Alloys Corporation
Canton, Ohio

4. WORKING

4a. Rolling

S. EPSTEIN, SECTION EDITOR

Improvement of Steel Rails by Modification of the Primary Structure in the Rail Foot by Rolling (Ueber die Verbesserung von Stahlschienen durch Umgestaltung des Primärgefüges im Schienenfuss beim Walzen) W. LÜCKERATH. *Mitt. Kohle-u. Eisenforsch. G.m.b.H. Dortmund,* Vol. 1, Dec. 1936, pp. 121-156. The origin of the solidification structure is explained and the possibility of achieving desired properties in the finished product by controlling primary crystallization is discussed. Again, as in the method of the Thyssen-Hütte A.G., improvement may be effected by control of the rolling operation. The crystallites of the ingot are hereby arranged parallel to the surface of the rolled material, by pressing the edges of the ingot towards the less stressed parts of the profile. A great number of photographs and tests illustrate the process in every detail and show the superiority of a rail rolled in this manner over the old method, particularly in elimination of the dangerous longitudinal cracks often encountered in the base of the rail. 23 references. Ha (4a)

Effect of Degree of Rolling, Rolling Temperature and the Thickness Ratio on the Rolling Process and the Mechanical Properties of the Rolled Material in Hot-rolling of Medium-Hard Carbon Steels (Einfluss des Walzgrades, der Walztemperatur und des Dickenverhaltnisses auf den Walzvorgang und die Festigkeitseigenschaften des Walzgutes beim Warmwalzen von mittelharten Kohlenstoffstählen) A. POMP & W. LUEG. *Mitt. Kaiser-Wilhelm-Inst. Eisenforsch. Düsseldorf,* Vol. 18, No. 13, 1936, pp. 183-204. Exhaustive original research. Steels with 0.28 and 0.43% C were investigated in the range from 700° to 1200° C. Tests showed that the resistance to deformation and, consequently, the rolling pressure and energy consumed in rolling decrease considerably wih increasing temperature. Temperature was, however, of little influence on the spreading in rolling. The ratio of thickness of roll to that of the material to be rolled had a great influence on deformation resistance, which was reduced to about half when the ratio was quadrupled. The composition of the steel was effective only at lower rolling temperatures where steel with higher C showed higher roll pressures and deforming resistance; at higher temperatures this difference disappeared and at 1200° C. the softer steel gave somewhat higher values. The best mechanical properties were obtained in steels rolled at 800°-900° C. Degree of reduction showed no effect on the properties. The finest structure was found in the steels rolled at 700° C.; the structure is much coarser at 1000° C. rolling temperature, and very coarse at 1200° where the structure resembles that of an overheated steel. 12 references. See also *Metals and Alloys,* Vol. 6, Nov. 1935, p. MA 444R/5. Ha (4a)

Electrical Improvements in Steel Plant Operation. JOHN LISTON. *Blast Furnace Steel Plant,* Vol. 25, Jan. 1937, pp. 79-80. Reviews 1936 developments of General Electric Co. in drives and other equipment for rolling-mills, annealing and brazing furnaces, and atmosphere control equipment. MS (4a)

Roughing Operations on New Homestead Plate Mill Are Controlled Automatically. *Steel,* Vol. 100, Jan. 18, 1937, pp. 44-46, 64. Describes electrical equipment and its operation for control of 100-in. semicontinuous plate-mill at Homestead Steel Works of Carnegie-Illinois Steel Corp., Munhall, Pa. MS (4a)

Reversing Roughing Unit with Vertical Roll Edger Features Homestead Sheared Plate Mill. *Steel,* Vol. 100, Jan. 18, 1937, pp. 38-43, 64. **New Homestead Semi-continuous Plate Mill Sets High Efficiency Standard.** *Iron Age,* Vol. 139, Jan. 21, 1937, pp. 37-41. **100-in. Plate Mill Combines Precision with Large Output.** *Blast Furnace Steel Plant,* Vol. 25, Feb. 1937, pp. 195-200, 218, 233. Illustrated description of 100-in. semicontinuous plate mill and accessory equipment of Carnegie-Illinois Steel Corp. at Homestead Steel Works, Munhall, Pa. Annual capacity is 729,000 gross tons. Product will be 20-90 in. wide and 3/32-5/8 in. thick. Will roll alloy as well as C steels. Includes 3 continuous type reheating furnaces; a 2-high scale breaker, 36 x 100 in.; a hydraulic descaler; a 4-high non-reversing broadside mill, 42 x 52 x 120 in.; a horizontal slab edging press; a vertical reversing roll edger, 40 x 10 in.; a hydraulic descaler; a 4-high reversing roughing stand, 36 x 54 x 100 in.; a double pinch roll device serving as a scale breaker; a hydraulic descaler; 4 4-high finishing stands, 27 x 54 x 100 in.; connecting tables; shears; levelers; etc. End shears are of rocking type, in which curved shear blade rocks across plate with only point contact, eliminating "shear bow" formerly encountered. MS + VSP (4a)

Hot Rolling (Die Warmwalzung) L. WEISS (Frankfurt) *Z. Metallkunde,* Vol. 28, Nov. 1936, pp. 331-335. Theoretical discussion. The fundamentals of rolling are discussed mathematically and it is shown experimentally that the work required is proportional to the differences between the original and final cross-sections of the sheet. GD (4a)

2 **Flow of Work During Rolling (Beitrag zur Kenntnis des Werkstoffflusses beim Walzvorgang)** H. UNCKEL. *Arch. Eisenhüttenw.,* Vol. 10, July 1936, pp. 13-18. To study the flow of the work the surfaces of Al plates were marked with a network of square ruled lines, holes were drilled in various directions, and laminated plates were built-up and rolled. Bending of lines perpendicular to the rolling direction occurred; spreading was uniform over the plates. The various flow effects observed are illustrated and an analysis of flow lines made. SE (4a)

3 **Employ Specially-designed Conveyors to Facilitate Handling of Strip Steel.** *Steel,* Vol. 100, Feb. 15, 1937, pp. 49-50. Illustrated description of several applications. MS (4a)

4 **Granite City Steel Completes Continuous Strip Mill Installation.** R. E. MILLER (Staff) *Iron Age,* Vol. 139, Mar. 4, 1937, pp. 38-43. Illustrates and describes a continuous 90-in. hot strip mill and a reversing 48-in. cold strip mill recently installed by the Granite City Steel Co., Granite City, Ill. In addition to rolling of strip, sheets and plates up to 84-in. wide, the hot mill layout permits rolling of plates over 90 in. VSP (4a)

The Roll Problem in Backed-up Mills for Cold Reduction. G. A. V. RUSSELL & S. S. SMITH. *Engineer,* Vol. 162, Nov. 13, 1936, pp. 515, 517. Includes discussion. See *Metals and Alloys,* Vol. 8, Apr. 1937, p. MA 207L/8. LFM (4a)

5 **Present-day Problems of the Rolling-mill Industry.** ALBERT NÖLL *Engineering,* Vol. 142, Dec. 25, 1936, pp. 708-711. *Blast Furnace Steel Plant,* Vol. 24, Oct. 1936, p. 897; Nov. 1936, pp. 993, 1008. **(Zeitgemässe Fragen aus dem Gebiete des Walzwerkswesens)** *Stahl u. Eisen,* Vol. 5, Sept. 17, 1936, pp. 1091-1112. See *Metals and Alloys,* Vol. 8, Feb. 1937, p. MA 74R/6. LFM + MS + SE (4a)

6 **New Hoop Steel and Tube Strip Rolling Plant.** BERNARD BURDEWICK & T. SODA. *Iron Steel Ind.,* Vol. 10, Dec. 1936, pp. 182-186. See *Metals and Alloys,* Vol. 8, Feb. 1937, p. MA 74R/5. CMS (4a)

Lubrication of Modern Rolling Mills. L. BALLARD. *Blast Furnace Steel Plant,* Vol. 25, Feb. 1937, pp. 191-194, 226. Discusses lubrication of open, anti-friction, and oil-film roll-neck bearings, and of reduction gears and pinions; care of oils in circulating systems; and oil storage and handling. MS (4a)

Survey of Cold Rolling Practice. J. W. BERRY. *Blast Furnace Steel Plant,* Vol. 24, Jan. 1936, pp. 93, 99; Feb. 1936, p. 173; Mar. 1936, p. 245. *Sheet Metal Ind.,* Vol. 9, Dec. 1935, pp. 753-754. See *Metals and Alloys,* Vol. 7, Apr. 1936, p. MA 182L/5. MS + AWM (4a)

8 **Cold Rolling and Annealing.** C. A. EDWARDS, D. L. PHILLIPS & W. H. E. GULLICK. *Blast Furnace Steel Plant,* Vol. 24, Sept. 1936, pp. 809, 819. See *Metals and Alloys,* Vol. 7, Oct. 1936, p. MA 507L/4. MS (4a)

Handling Steel for Modern Mills. *Blast Furnace Steel Plant,* Vol. 24, Aug. 1936, pp. 679-684. **Bethlehem Enters Strip-Sheet Market with Opening of $20,000,000 Continuous Mill.** *Steel,* Vol. 99, July 6, pages 44, 46, 48, 52. **Three 50-Ton Recuperative Furnaces Serve New Continuous Sheet Mill.** *Steel,* Vol. 99, July 27, 1936, p. 55. Describes rolling mill equipment and slab heating furnaces for Bethlehem's new Lackawanna mill. See *Metals and Alloys,* Vol. 7, Oct. 1936, p. MA 496R/4. MS (4a)

New 4-High Cold Mill Rolls Strip Steel for Tinning. *Steel,* Vol. 100, Mar. 15, 1937, pp. 72-73. **Republic Opens New Cold Mill at Niles, Ohio.** *Iron Age,* Vol. 139, Mar. 18, 1937, pp. 41a-41c. Brief description of mill of Republic Steel Corp. at Niles, Ohio. Consists of 4 stands of 4-high cold mills having rolls 18 and 49 in. in diam. and 42 in. face. Black plate is rolled on 4 tandems of 3 stands each of 2-high cold rolls, 24 in. diam. and 44 and 48 in. long. MS + VSP (4a)

4b. Forging & Extruding

A. W. DEMMLER, SECTION EDITOR

Drop Forgings. P. ROWLEY. *Iron & Coal Trades Rev.,* Vol. 134, Mar. 5, 1937, p. 445. A drop forging is defined as an article formed between dies by the flow of hot, plastic metal, whereby a change of both the form and the section of the material is involved. The proper design of the die is discussed and requirements as to material and heat treatment, especially soaking, are specified. Reheating furnaces and fuel are discussed; forging temperatures between 1000° and 1200° C. are used preferably. Stresses set up in forging various shapes are described. Ha (4b)

Forming and Forging. F. L. PRENTISS. *Iron Age,* Vol. 139, Jan. 7, 1937, pp. 363-367; Jan. 28, pp. 26-31, 85. General survey of recent developments. Marked improvement in equipment, increased production rate, and increased precision of product characterize the year's developments in forging. Press and coin forging are on the increase. Crankshaft forging speeds have been increased by improved hammer design. An interesting forging job was the production of 4-in. anchor chain made at the Boston Navy Yard. See *Metals and Alloys,* Vol. 7, Aug. 1936, p. MA 401L/5. VSP (4b)

Forging the Crankshafts of Aircraft Engines in U.S.S.R. (Le Forgeage des Vilebrequins de Moteurs d'Aviation en U.R.S.S.) MICHEL PRÉCOUL. *Aérophile,* Vol. 44, May 1936, p. 110. Practice in Russia is to make aero crankshafts from Ni-Cr-W or Ni-Cr-Mo steel, melted in an electric furnace, and cast in ingots of carefully adjusted dimensions. The ingots are cooled slowly to below 200° C. to prevent cracking, "Homogenized" for 4-5 hrs., cooled to 200° C., reheated to 600° C. for 4-6 hrs., and cooled at 30°-50°/hr. Reheating for forging is done slowly; reduction is in two stages at 1150°-875° C. with an intermediate reheating but without intermediate stress-relief anneal. A bending operation in dies and a final drop-stamping operation follow, and the crankshaft is finally heat treated. JCC (4b)

Manual Operations Predominate in Manufacturing High Quality Axes. *Steel,* Vol. 100, Feb. 15, 1937, pp. 66, 69. Describes processes followed in making hand-forged axes at plant of Warren Axe & Tool Co., Warren, Pa. MS (4b)

Forging and Stamping. *Steel,* Vol. 100, Jan. 4, 1937, pp. 278-279, 424. Review of developments during 1936 as seen by various authorities. MS (4b)

Die Forged Locomotive Rods. *Iron Age,* Vol. 139, Feb. 4, 1937, pp. 67-71. Describes die forged main and side rods of Cr-Ni-Mo steel, heat treated to secure the best physical properties and operating on tapered roller bearings. These rods are made by Timken Roller Bearing Co. from high dynamic steel. The typical composition of the steel is 0.36% C, 0.70% Mn, 0.015% P, 0.013% S, 0.27% Si, 0.75% Cr, 1.75% Ni and 0.25% Mo. VSP (4b)

Fatigue in Relation to Failures in Forgings. ROBERT A. MACGREGOR. *Metal Treatment,* Vol. 2, Winter 1936, pp. 173-180. Review. Notch sensitivity, the fatigue strength of welds, scale effect, under- and over-stressing, corrosion fatigue, and damping capacity are briefly discussed. Examples of fatigue failures in marine forgings are illustrated. JCC (4b)

Forged Roller Bearings. A. G. AREND. *Engr. of India,* Vol. 3, Dec. 1935, pp. 243-245. A practical description of the uses and modern improved system of production of forged roller bearings and the reasons for the slowness in their more general application in industry. APS (4b)

Buick Takes Another Forward Step in Forging Practice. ROBERT H. DARNTON (Buick Motor Co.) *Iron Age,* Vol. 139, Mar. 25, 1937, pp. 28-29, 50. Describes new equipment and methods used by Buick Motor Co. in forging crankshafts. VSP (4b)

Investigation of the Forgeability of Different Light-metal Alloys (Untersuchung über die Schmiedbarkeit verschiedener Leicht-metall-Legierungen) A. PORTEVIN & P. G. BASTIEN. *Aluminium,* Vol. 18, Nov. 1936, pp. 558-563. See *Metals and Alloys,* Vol. 8, Jan. 1937, p. MA 12R/6. Ha (4b)

Making Upsets in Stock by Electric Resistance Heating in Butt Welders. *Steel,* Vol. 99, July 20, 1936, p. 36. Describes method of producing electric resistance upsets in a butt welder by single or multiple push-ups. MS (4b)

4c. Cold Working — Shearing, Punching, Drawing & Stamping

The Forming Properties of Some Non-ferrous Sheet Metals. G. R. GOHN. *Proc. Am. Soc. Testing Materials,* Vol. 36, Pt. II, 1936, pp. 207-220; discussion p. 221. Data on forming tests are tabulated showing the minimum radii for forming 90° bends in various thicknesses, tempers and alloys of brass, phosphor bronze, nickel silver, aluminum and miscellaneous sheet metals. Application of the data presented has demonstrated the practicability of using them in the design of formed parts and forming tools. VVK (4c)

Colloidal Graphite as a Die-casting Lubricant. WILLIAM JENNINGS. *Iron Age,* Vol. 139, Feb. 25, 1937, pp. 41, 82. Die-castings subjected to high temp. can be satisfactorily lubricated by use of lubricants containing colloidal graphite. These lubricants do not lose their viscosity or chemically decompose under high heat. Graphoid surfaces not only possess a low coefficient of friction but are also resistant to oxidation and are incombustible below 600° C. More efficient production can be obtained by occasional treatment with a colloidal graphited oil of the core slides, plugs, screws, hinges or other moving parts of die-casting mechanisms. VSP (4c)

Cold-heading—Bolts, Rivets, Nails. ROY H. SMITH. *Wire & Wire Prod.,* Vol. 12, Feb. 1937, pp. 83-88. Modern cold-heading practice is described, single and multiple blow heading methods discussed, and machinery and products illustrated. Ha (4c)

History and Development of the Art of Cold Drawing Steel Bars. H. E. MACK. *Steel,* Vol. 100, Feb. 15, 1937, pp. 38-42, 44, 80-81. Describes operations involved and equipment used in manufacture of cold-drawn bars. Pays some attention to turned rounds. MS (4c)

Non-ferrous Tubes and Fittings. *Times [London] Trade & Engineering,* New Series, Vol. 39, Oct. 1936, page 40. Outlines process of tube manufacture at plant of Yorkshire Copper Works, Leeds, Eng. MS (4c)

Wiredrawing. *Times [London] Trade & Engineering,* New Series, Vol. 39, Oct. 1936, page 28. Outlines process of manufacturing wire. MS (4c)

4d. Machining

H. W. GRAHAM, SECTION EDITOR

Selection of Tool Steels. W. H. TROON & C. R. DAY. *Heat Treating and Forging,* Vol. 22, Oct. 1936, pages 511-516, 520. Discusses factors governing choice of steels for tools used for cutting and forming of metals. Among these are equipment available for heat treating; time allowed for treating; quantity of work required from tool; cost of tool-steel; cost of machining compared with cost of steel and its heat treatment; tool design; distortion; mass of tool; hardness and toughness; resistance to wear; and temperature of service. Gives a number of typical compositions for various purposes. MS (4d)

Drilling Hardened and Tempered Nickel-chromium Steel. F. W. MÜLLER. *Metal Treatment,* Vol. 2, Autumn 1936, pp. 142-143. See *Metals and Alloys,* Vol. 7, Nov. 1936, p. MA 530R/10. JCC (4d)

Free-cutting Steels. *Metal Treatment,* Vol. 2, Autumn 1936, pp. 119-124. Summarized translation from *Stahl u. Eisen* of papers by Pagel, Stein, Rapatz, and Weidtmann. See *Metals and Alloys,* Vol. 8, Feb. 1937, p. MA 76. JCC (4d)

High-speed, Intermediate-cost Cutting Alloy Now Available Nationally. *Steel,* Vol. 99, Aug. 31, 1936, p. 57. Deals with "Crobalt." Similar to *Iron Age,* Vol. 138, Sept. 10, 1936, pp. 56-57. See *Metals and Alloys,* Vol. 8, Mar. 1937, p. MA 141L/5. MS (4d)

Machine Lapping, A Method for Finest Finishing (Maschinelles Läppen, ein Arbeitsverfahren der Feinstbearbeitung) E. PALLAS. *Oberflächentech.,* Vol. 14, Feb. 16, 1937, pp. 37-39. Honing is employed to produce, in bearings, such exact fitting of the journal in the bushing that practically no wear occurs in later use. Procedure, equipment, material most suitable for the latter, and lapping materials are discussed. Ha (4d)

5. HEAT TREATMENT

O. E. HARDER, SECTION EDITOR

Steel Treating in Controlled Atmospheres. *Metal Treatment,* Vol. 2, Winter 1936, pp. 184-189. See *Metals and Alloys,* Vol. 7, Mar. 1936, p. MA 125L/1. JCC (5)

Follsain Treatments. MARK BARR. *Metal Treatment,* Vol. 2, Autumn 1936, pp. 144-147 Descriptive. The Follsain H. T. Penetral treatment, developed originally for protecting the air preheating tubes of an ore sintering kiln, consists in heating Fe or steel articles at 1000° C. in a mixture of carborundum with the chlorides of Al and Cr. A hard coating, resistant to high temperature oxidation and corrosion, is produced. Abrasion resistant coatings (SH treatment) and coatings resistant to attack by molten Zn (AR process) are obtained by modifications of the mixture. New alloys developed include EVHI for heat treatment boxes and Cy for abrasion resistance. JCC (5)

Some Recent Noteworthy Advances in Rail Manufacture. *Steel,* Vol. 98, June 8, 1936, pp. 34-38. *Railway Age,* Vol. 100, June 13, 1936, pp. 940-944. See *Metals and Alloys,* Vol. 8, Feb. 1937, p. MA 80R/9. MS (5)

Heat Treating and Refractories. CHARLES R. AUSTIN. *Iron Age,* Vol. 139, Jan. 7, 1937, pp. 533-536, 538-540, 542, 544. Discusses some of the most important features of heat treatment of complete sections and surface conditioning of ferrous alloys, and their commercial applications in recent years. Some of the topics considered are: Role of grain size; grain size control by Al; age hardening; carburizing; cyaniding; nitriding; and flame hardening. VSP (5)

Heat Treating. *Steel,* Vol. 100, Jan. 4, 1937, pp. 272-274, 426-427. Review of progress in heat treating during 1936 as seen by various authorities. Most interesting and significant development was the Tocco process of differential hardening by induction heating. MS (5)

5a. Annealing

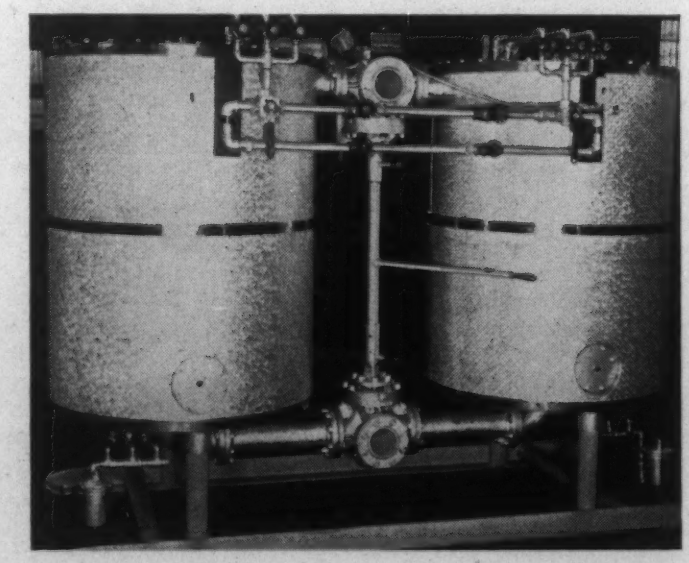
Annealing in Tube Type Furnaces. *Blast Furnace Steel Plant,* Vo. 24, Sept. 1936, pp. 790, 827. **Annealing Covers for Sheet and Strip.** *Steel,* Vol. 99, Aug. 10, 1936, pp. 48-49. Similar to article by Lee Wilson in *Ind. Heating,* Vol. 3, Aug. 1936, pp. 523-525. See *Metals and Alloys,* Vol. 7, Oct. 1936, p. MA 494L/6. MS (5a)

Effect of Iron Impurities on the Annealing of High Brass. W. A. GIBSON & J. H. DOSS. *Proc. Am. Soc. Testing Materials,* Vol. 36, Pt. II, 1936, pp. 201-206. *Metal Ind., N. Y.,* Vol. 34, Sept. 1936, pp. 333-334. *Sheet Metal Ind.,* Vol. 10, July 1936, pp. 515-516. See *Metals and Alloys,* Vol. 7, Dec. 1936, p. MA 603L/4. VVK + CBJ + AWM (5a)

Nucleus Formation During Recrystallization III. Orientation of Recrystallization Nuclei (Ueber die Keimbildung bei der Rekristallisation III. Die Orientierung der Rekristallisationskeime) M. KORNFELD. *Physik. Z. Sowjetunion,* Vol. 10, No. 2, 1936, pp. 142-153. In German. Pursuing previous research (*Metals and Alloys,* Vol. 6, May 1935, p. MA 204R/1; Vol. 7, July 1936, p. MA 362L/5) it is shown that the speed of formation of recrystallization nuclei is greatest in the region of the plastically deformed crystal whose orientation differs most from the preferred. See *Metals and Alloys,* Vol. 7, Aug. 1936, MA 413R/3. EF (5a)

Stress-relief Annealing High-strength Monel Metal Plate. PETER R. KOSTING. *Proc. Am. Soc. Testing Materials,* Vol. 36, Pt. II, 1936, pp. 222-230; discussion 231-238. See *Metals and Alloys,* Vol. 7, Dec. 1936, p. MA 581L/1. VVK (5a)

Influence of Isothermal Treatment on Mechanical Properties of Steel. V. D. SADOVSKI. *Kach. Stal,* Vol. 4, No. 10, 1936, pp. 42-44. In Russian. General comments. (5a)



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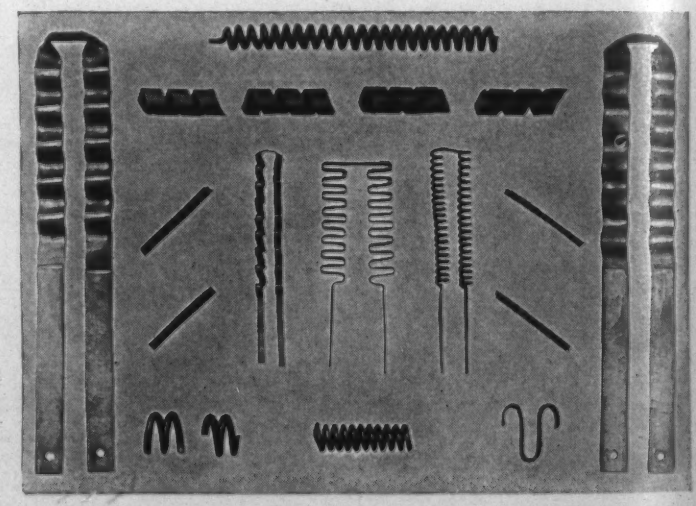

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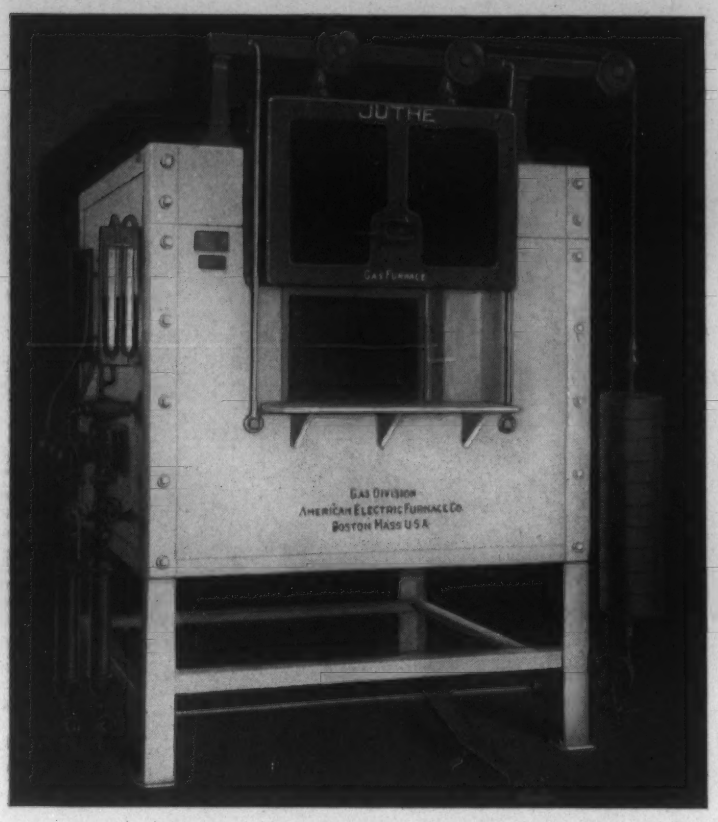

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5b. Hardening, Quenching & Drawing

1 **The Heat Treatment of Cast Iron by Hardening and Tempering.** J. E. HURST. *Trans. Am. Foundrymen's Assoc.*, Vol. 7, Dec. 1936, pp. 373-397. *Iron Steel Ind.*, Vol. 10, Dec. 1936, pp. 213-216, and Vol. 10, Jan. 1937, pp. 249-252. *Foundry Trade J.*, Vol. 54, May 21, 1936, pp. 400-406. One of the outstanding developments in cast iron metallurgy is the hardening and tempering of that material. Although the effect of hardening on cast iron was known as early as 1839, the effect of tempering in improving the properties is a modern development and is due to research 2 and investigation. The author discusses the effect of hardening and tempering on the mechanical properties, the effect of casting condition and composition on properties obtainable, the effect of hardening and tempering on the stress-strain diagram and on the modulus of elasticity. The second section is devoted to a discussion of the mechanism of hardening and tempering and discusses such points as the effect of C, C plus Si, quenching temperatures, the influence of chemical composition and alloy additions, their effect on the depth of hardening, the stabilizing effect of Mo on 3 the strength of N-hardening cast iron, and on alloy's effect on quenching speed. The effect of hardening and tempering on internal stresses is explained. 15 curves are shown. CEJ + AIK (5b)

Surface Hardening with the Torch (La Trempe Superficielle au Chalumeau) VILLEZ. *Usine*, Vol. 46, Jan. 14, 1937, p. 29. Methods for local hardening of surfaces, gears, etc., manually or by machines, are briefly reviewed. Ha (5b)

4 **Deformation Method in the Study of the Quenching of Steel.** S. A. KAZEEV (Central Inst. Metals, USSR) *Metallurg*, Vol. 11, Nov. 1936, pp. 58-68. In Russian. Mathematical treatment of conditions occurring during quenching based largely on experimental data of French and some original work. (5b)

Conditions Necessary for Uniform Heat Treatment of Steel (Die Bedingungen für die Durchvergütung von Stahl) H. 5 KRAINER. *Arch. Eisenhüttenw.*, Vol. 9, June 1936, pp. 619-622. Original research. By uniform heat treatment is meant that all parts of the cross-section should have approximately the same tensile properties after quenching and tempering. A 0.5% C, 1.1% Cr, and 0.25% Mo steel (8 mm. diam. rod) was quenched from 800° C. into constant temperature baths held at from 300-450° C. until transformation of the austenite occurred. The specimens were then tempered for 15 min. at the temperature (from 300-600° C.) required to give uniform tensile properties through- 6 out the section. The specimens quenched into the constant temperature baths held at the higher temperatures had the higher uniform tensile properties after tempering. SE (5b)

Hardening with the Hand Welding Torch (Härten mit dem Handschweissbrenner) E. RUCK. *Autogene Metallbearbeit.*, Vol. 30, Feb. 15, 1937, pp. 52-55. Advantages of manual hardening over hardening machines are described by several examples with 7 small objects. Ha (5b)

5c. Aging

On the Phenomenon of Incubation of Alloys. KOTARO HONDA & KANZI TAMARU. *Kinzoku no Kenkyu*, Vol. 14, Feb. 1937, pp. 41 to 45. In Japanese. *Sci. Repts. Tohoku Imp. Univ.*, Vol. 25, Honda Anniversary Issue 1936, pp. 677 to 685. In English. See *Metals and Alloys*, Vol. 8, Feb. 1937, p. MA 83L/2. 8 KT (5c)

5e. Carburizing

Case Hardening with Calcium Cyanide. N. F. VIAZNIKOV & 9 F. K. MIKHALEV. *Metallurg*, Vol. 11, Oct. 1936, pp. 73-77. In Russian. A study of case hardening in a bath containing 2% $Ca(CN)_2$. (5e)

Structure of Outer Layer on Annealing Iron-carbon Alloys in Hydrogen (Ausbildung der Randschicht beim Glühen von Eisen-Kohlenstoff-Legierungen in Wasserstoff) W. BAUKLOH. *Arch. Eisenhüttenw.*, Vol. 10, Nov. 1936, pp. 217-219. Steels of up to 0.9% C showed no visible decarburization on annealing in H_2 at 10 temperatures of 750-1050° C. Higher C alloys showed a visible decarburized layer, the C content of which depended on the solubility of C in γ-iron at the given temperature. It is suggested that cast Fe annealed in H_2 at the proper temperature may form a surface of 0.9 to 1.7% C steel. SE (5e)

6. FURNACES, REFRACTORIES AND FUELS

M. H. MAWHINNEY, SECTION EDITOR

Notes on Gas Fired Furnaces. HALE A. CLARK. *Heat Treating and Forging,* Vol. 22, Dec. 1936, pages 633-635. Report of the 1936 Ferrous Metals Committee, Industrial Gas Section, American Gas Association. MS (6)

Economics of Modernizing the Open-hearth Furnace. GEORGE L. DANFORTH. *Blast Furnace and Steel Plant,* Vol. 24, Dec. 1936, pages 1087, 1101. About 20% of present United States open-hearth capacity should be scrapped and replaced by completely new units; about 60% can be economically modernized; and large portion of remaining 20% can be materially improved at a minor expense. Detailed cost data for a typical furnace are given. MS (6)

Refractory Linings for Electric Furnaces (Les Pisés Réfractairs pour Fours Électriques) *Journal du Four Electrique,* Vol. 45, Nov. 1936, pages 389-390. General description. JDG (6)

Metal-finishing Ovens. *Ind. Finishing,* Vol. 12, Oct. 1936, pp. 20-22, 24, 26. Major points to consider in selection of new ovens or reconditioning of old ones for bake finishing are: Oven construction; method of heating; and material handling. Predominating type of construction is the insulated panel. Method of handling is influenced by the material itself and position of oven in plant production schedule. Other problems are ventilation and space heating. VSP (6)

Note on a New Dry-press De-airing Device. C. E. CURTIS. *J. Am. Ceram. Soc.,* Vol. 19, Nov. 1936, pp. 315-317. A direct de-airing method is described and operation shown to give non-cracking brick of high quality. WB (6)

Constructing Brass Furnaces. *Foundry,* Vol. 65, Jan. 1937, pp. 27, [illegible]. Gives helpful instructions for the construction of coke-fired pit-type brass furnaces. VSP (6)

Gas-fired Radiant-tube Annealing Cover for Treating Coiled Bolt Stock. *Steel,* Vol. 98, May 25, 1936, p. 46. Descriptive. MS (6)

2 **Pouring Pit Refractories; Their Effect on Alloy Steel Quality.** E. E. CALLINAN. *Steel,* Vol. 99, July 13, 1936, pp. 35-36, 38, 40. Paper presented before the Ohio Ceram. Ind. Assoc. See *Metals and Alloys,* Vol. 7, Nov. 1936, p. 584R/8. MS (6)

Slag Resistance of Steel Works Refractories. J. H. CHESTERS. *Blast Furnace Steel Plant,* Vol. 24, June 1936, pp. 543-544; July 1936, pp. 633-634. From paper read before the Refractory Materials Section of the Ceramic Society. See *Metals and Alloys,* Vol. 7, Oct. 1936, p. MA 496R/5. MS (6)

3 **Extrusion and Annealing of Chevrolet Motor Valves.** J. B. NEALEY. *Heat Treating Forging,* Vol. 22, Oct. 1936, pp. 523-524. See *Metals and Alloys,* Vol. 8, Apr. 1937, p. MA 207R/2. MS (6)

The Baby Cupola. GUY HÉNON. *Iron Age,* Vol. 138, Dec. 10, 1936, pp. 46-49, 89. See *Metals and Alloys,* Vol. 8, Apr. 1937, p. MA 215R/4. VSP (6)

4 **Liquefied Petroleum Gases.** MARTIN J. CONWAY. *Iron Age,* Vol. 138, July 23, 1936, pp. 30-33, 59. See *Metals and Alloys,* Vol. 7, Sept. 1936, p. MA 447L/4. VSP (6)

Modern Electric Furnaces. *Elec. Rev.,* Vol. 120, Jan. 22, 1937, p. 138. Brief illustrated description of several furnaces built by Metalectric Furnaces, Ltd., Birmingham, Eng. MS (6)

5 **The Mineral Constitution of Various Ceramic Clays.** R. E. GRIM & R. A. BRAY. *J. Amer. Ceram. Soc.,* Vol. 19, Nov. 1936, pp. 307-315. Data tabulated and discussed. WB (6)

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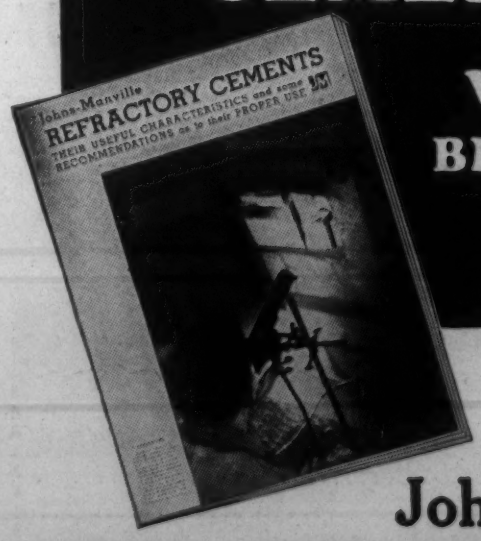

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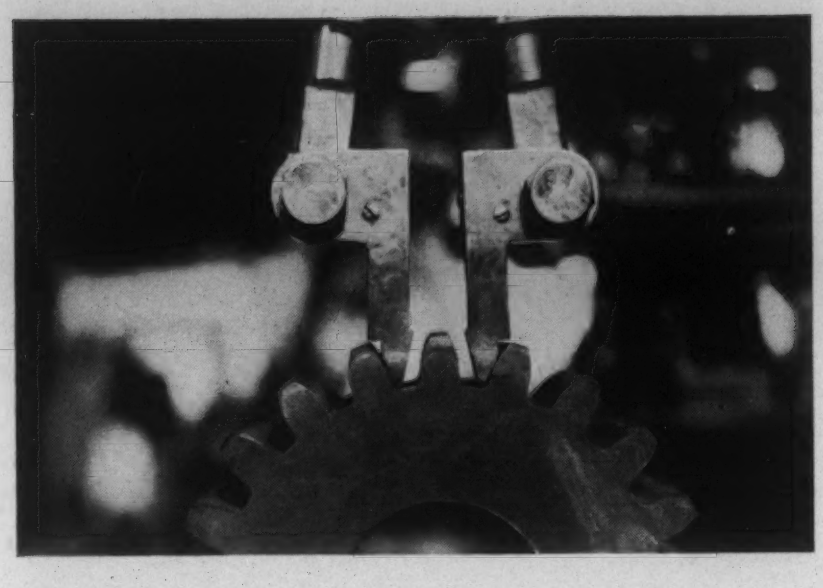

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(MA-6)

Problems of Automatic Temperature Control of Electric Furnaces (Probleme der automatischen Temperaturregelung bei elektrischen Oefen) L. BEUKEN. *Elektrowärme,* Vol. 6, Dec. 1936, pp. 333-335. Principles, factors and methods involved in
1 control of temperature within narrow limits, ($\pm 1°$) are discussed, with typical operating examples. Ha (6)

Checker Bricks in Open-hearth Furnaces. W. C. BUELL, JR., *Ind. Heating,* Vol. 4, Feb. 1937, pp. 148-152. Factors (such as
— gas flow, dust deposition and attack and proper maintenance) essential to efficient checker brick performance are discussed. Ha (6)

2 **Bonding Agents for Refractories.** *Chem. Trad J.,* Vol. 99, Sept. 11, 1936, p. 221. Condensed from *Chem. Ind.,* Vol. 39, Aug. 1936, pp. 145-147. Possible applications of ethyl silicate
— solutions are described. Partially hydrolyzed silicic acid ester is suggested as an excellent bonding material for a variety of ceramic articles; the very sticky colloidal silicic acid deposited by hydrolysis dries to hard vitreous-like silica. Price considerations exclude its use in making ordinary refractory brick, but some special refractory
3 applications are suggested. MS (6)

Using Refractory Concrete in Annealing Furnaces. *Steel,* Vol. 99, Aug. 3, 1936, pp. 34-37. Describes use of refractory concrete
— made with Al_2O_3 for lining doors and making car tops and precast arches. For last named, see *Metals and Alloys,* Vol. 7, Oct. 1936, p. MA 496L/9. MS (6)

Designs Tube Annealing Furnace. *Steel,* Vol. 99, Sept. 7, 1936, pp. 66, 68. Same as *Ind. Heating,* Vol. 3, Aug. 1936, pp.
4 502-504. See *Metals and Alloys,* Vol. 7, Nov. 1936, p. MA 535L/10. MS (6)

New Galvanizing Furnace. W. H. SPOWERS, JR. *Heat Treating Forging,* Vol. 22, July 1936, pp. 356-358. See *Metals and*
— *Alloys,* Vol. 7, Sept. 1936, p. MA 447L/3. MS (6)

Heat Treating Closely Regulated. J. B. NEALEY. *Heat Treating Forging,* Vol. 22, Sept. 1936, pp. 473-475. See *Metals and*
5 *Alloys,* Vol. 8, Jan. 1937, p. MA 14L/2. MS (6)

Properties of Insulating Refractories. Pt. I. Behavior Under Load at High Temperatures. S. M. PHELPS. *Am. Refractories*
— *Inst. Tech. Bul.* No. 61, Dec. 1935, 6 pp. *Heat Treating Forging,* Vol. 22, May 1936, pp. 251-253. See *Metals and Alloys,* Vol 8, Jan. 1937, p. MA 18R/9. MS (6)

6 **Electric Heat Treating Developments in England.** A. G. ROBIETTE. *Heat Treating Forging,* Vol. 23, Feb. 1937, pp. 92-94, 96-97. From *Metallurgia,* Dec. 1937. See *Metals and Alloys,* Vol. 8, Apr. 1937, p. MA 216L/6. MS (6)

— **Influence of the Direction of the Gas on the Dimensions and Operation of Heat-treating Furnaces (Einfluss der Gasführung auf Ausgestaltung und Betrieb von Warmbehandlungsofen)** F. STANEK. *Z. Ver. deut. Ing.,* Vol. 80, Nov. 7, 1936, pp. 1355-
7 1357. Practical. Correctly arranged burners and flame direction can considerably reduce the size of a furnace and reduce operating cost. Ha (6)

— **The Capacity of a Modern Three-phase Arc Furnace (Die Leitung eines neuzeitlichen Drehstrom-Lichtbogenofens)** FRITZ WALTER (Siemens-Schuckertwerke, A.G.) *Electrowärme,* Vol. 7, Feb. 1937, pp. 25-30. Theoretical discussion of the effect of the charge, differences in electrodes and in electrical conditions of
8 Cu leads to furnace on phase irregularities. Practical application of theoretical principles is explained. Ha (6)

— **Fuels and Their Application.** EMIL VIEROW. *Blast Furnace Steel Plant,* Vol. 25, Jan. 1937, pp. 76-78, 84. *Heat Treating Forging,* Vol. 23, Feb. 1937, pp. 89-81, 96. Reviews recent developments of interest in steel manufacture. These include uni-
9 directionally fired soaking-pits, zone-fired reheating furnaces for rolling-mills; improved open annealing and normalizing furnaces, oil gasification and firing, radiant tube furnaces, and atmosphere control. MS (6)

— **Cuts Malleable Annealing Cycle 49 Per Cent.** CARL F. JOSEPH. *Iron Age,* Vol. 139, Feb. 18, 1937, pp. 28-31. Recently the Saginaw Malleable Iron division of General Motors Corp. reduced the annealing cycles of malleable Fe to 30 hr. This was accom-
10 plished by the perfection of a radiant heating tube and increased knowledge of controlled atmosphere. The furnace is a roller rail type continuous annealing furnace. Controlled atmosphere is around 12.5% CO and 6.5% CO_2. Gives detailed description of furnace. Includes table giving annealing time for the past 16 years. VSP (6)

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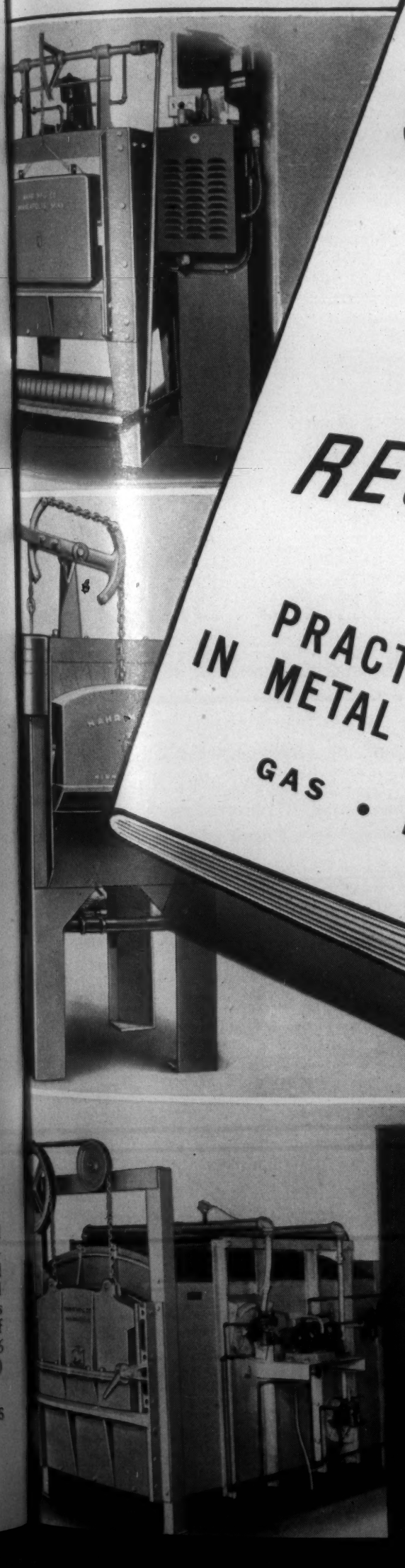

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Insulating Panels for Open-hearths Afford High Salvage of Brick. S. M. JENKINS (Armstrong Cork Products Co.) *Steel,* Vol. 100, Mar. 15, 1937, pp. 86, 88. Describes method of construction of open-hearth furnaces above charging floor, using insulating brick. MS (6)

Refractories Containing Magnesite. L. LITINSKY. *Blast Furnace Steel Plant,* Vol. 24, Sept. 1936, pp. 828, 830-831. Excerpt from *Iron Steel Ind.,* Vol. 9, Aug. 1936, pp. 462-466. See *Metals and Alloys,* Vol. 8, Apr. 1937, p. MA 215L/2. MS (6)

Some Observations Regarding Refractories for Iron Blast Furnaces. RAY A. LINDGREN. *Blast Furnace Steel Plant,* Vol. 25, Jan. 1937, pp. 138, 140; Feb. 1937, p. 238. See *Metals and Alloys,* Vol. 8, Jan. 1937, p. MA 22L/8. MS (6)

Draft Control as a Means of Fuel Conservation in Kiln Firing. *H. R. Straight. J. Am. Ceram. Soc.,* Vol. 19, Nov. 1936, pp. 318-321. Discussion of furnace regulation to obtain uniform heat treatment and fuel economy. WB (6)

Ford Plant in England Installs Special Annealing Furnace. *Heat Treating Forging,* Vol. 22, Oct. 1936, pp. 528, 531. MS (6)

New Furnace Treats Rails for Higher Ductility and Impact Resistance. *Steel,* Vol. 100, Mar. 15, 1937, p. 74. **New Brunorizing Furnace at Gary Works.** *Iron Age,* Vol. 139, Mar. 11, 1937, pp. 84-86. Brief description of Brunorizing (*Metals and Alloys,* Vol. 6, May 1935, p. MA 185L/1) furnace installed at Gary works of Carnegie-Illinois Steel Corp. It is 250 ft. long, 9½ ft. wide, gas fired, divided into 8 zones, and equipped with fans. Groups of 5-8 rails are introduced lengthwise, 6 groups being treated simultaneously. Rails are end-hardened by jets of compressed air. MS + VSP (6)

New Type Heating Elements. *Heat Treating Forging,* Vol. 22, Aug. 1936, p. 404. Describes "Tubular-Hairpins." MS (6)

Possible New Silica Products. *Blast Furnace Steel Plant,* Vol. 24, Aug. 1936, pp. 721-722. Observations on the production of silica brick. MS (6)

Progress in Furnace Refractories. JOHN D. SULLIVAN. *Mining and Met.,* Vol. 17, June 1936, pp. 299-301. Survey, covering use of refractories in basic open-hearth bottoms, roofs, front and back-walls, ports and bulkheads, checker chambers, ladles and nozzles. Notable trends include the use of low-Fe magnesite brick, unburned magnesite brick, unburned chrome brick, and Forsterite, improvements in uniformity of refractory products and the development of better patching and ramming mixes. VSP (6)

1

Variations in Furnace Temperature with Time. A. SHADA. *Zhur. Khim. Prom.,* Vol. 13, No. 20, 1936, pp. 1239-1240. In Russian. Mathematical treatment. The equation $T_2 = T_m - (T_m - T_n)e^{-rt}$, is derived, wherein T_2 is the temperature of the furnace wall at a given moment, T_m the maximum temperature of the furnace wall (a fixed value), T_n the initial temperature of the wall (also fixed), t the time, and r the sum of the coefficients of thermal conductivity, radiation and convection divided by the specific heat (volume basis) of the furnace wall. NA (6)

2

Forced Convection Heating and Its Control. LEROY A. LINDBERG. *Heat Treating Forging,* Vol. 23, Jan. 1937, pp. 37-39, 44. Practical, Rapid heating and uniform temperatures are attained in furnaces in which work is heated only by powerful currents of hot air or gases driven through it by blowers. Describes electrically-heated and gas-fired furnaces and recently developed automatic unit for accurate temperature control. MS (6)

3

Mullite Development in Super-duty Fireclay Brick. FRED A. HARVEY & RAYMOND E. BIRCH. *J. Amer. Ceram. Soc.,* Vol. 19, Nov. 1936, pp. 322-327. Tests of super-duty fireclay brick are described and discussed. X-ray showed specimens fired to 11, 13, 18 cone contained approximately 50% mullite, while petrographic analysis showed distinct mullite crystals only in the 18 cone brick. WB (6)

4

Refractories. *Times Trade & Eng.,* Vol. 40, Jan. 1937, p. 18. Review of trends and developments during 1936. MS (6)

Direct Resistance Heating of Steel (Unmittelbare Widerstandserhitzung von Stahl) FR. KNILL. *Elektrowärme,* Vol. 7, Mar. 1937, pp. 61-67. A theoretical discussion of methods in which the object to be heated is part of the electric circuit. Advantages discussed. Ha (6)

5

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Performancce Report— *Subject:* Heat-treating, natural gas furnace, 39x39x39", with alloy steel muffle 13" high by 16" wide by 32" deep. Six inspirator type burners, with complete combustion in the SRM burner tunnel. Walls of 4½" Taylor Refractory Insulating Brick and 2½" Sil-O-Cel—total thickness of 7", with a 9" arch of Taylor Refractory Insulating Brick.

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Carburizing at 1700° F., a 150-pound charge is placed in the furnace at 4:40 p.m. at 1000° F. At 6:00 p.m. temperature has reached 1700° F., and after five hours at this temperature, the charge is removed with a total gas consumption of 672 cu. ft. Depth of case is .05".

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Processing—Accepting the above figures as average production, with fuel costing 50 cents per 1000 cu. ft., 251 pounds of high-priced alloy tool steel is processed at a cost of $0.579 or $0.0023 per pound.

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7. JOINING

Aluminum Joints in the Electrical Industry (Aluminiumverbindungen in der Elektrotechnik) W. BÜNGNER & W. HAMMERSCHMIDT. *Aluminium,* Vol. 19, Feb. 1937, pp. 86-88. Joining methods with and without fluxes are described. A joint made by melting 2 ends together without flux is recommended. Ha (7)

Welding, Soldering and Riveting; Joining Methods for Aluminium. *Times Trade and Eng.,* Vol. 40, Mar. 1937, p. 28. Describes methods in current use. MS (7)

7a. Soldering & Brazing

C. H. CHATFIELD, SECTION EDITOR

Observations on Brazing of Light Metals in the Electric Furnace (Beobachtungen bei der Leichtmetall-Hartlötung im elektrischen Ofen) M. MAIER. *Aluminium,* Vol. 18, Dec. 1936, pages 618-621. For joining thin sheet, wire, etc., brazing is more feasible than welding; the temperatures used (580-620° C.) can be maintained more uniformly in a furnace than with a torch. Applications are described. Ha (7a)

Soldering and Brazing. *Times [London] Trade & Engineering,* New Series Vol. 39, Oct. 1936, page 34. Deals with developments in soft solders, brazing alloys, and electric furnace brazing. MS (7a)

Can Tin Solders Be Replaced by other Soft Solders? (Sind die Lötzinn-Legierungen durch andere Weichlote ersetzbar?) ALEX. SCHAEFER. *Metallwirtschaft,* Vol. 16, Jan. 15, 1937, pp. 61-63. Original research. The use of more than 40% tin in solders is forbidden in Germany. This research was undertaken with the intention of replacing tin solders by those of metals available in Germany. Cd-Zn solders spread, flow and adhere as well as tin solders, at the same time producing a joint of greater shear strength. A solder corresponding to the eutectic in the Cd-Zn system (17.4% Zn) melts at 265° C.—about 30° higher than the melting point of a 40% tin solder. The author states that Cd-Zn solders can be used for steels, Cu and with suitable alloying additions for Mg and Al. GA (7a)

Soldering (Das Löten) K. BIHLMAIER. *Mitt. Forsch.-Inst. Probieramts Edelmetalle,* Vol. 10, Aug./Sept. 1936, pp. 68-72; Oct. 1936, pp. 84-86; Jan./Feb. 1937, pp. 108-113. General discussion of the soldering process. Types of joint (depending on extent of mutual solubility of solder and work), types of solders (compositions, properties, applications) and appropriate fluxes are covered. Ha (7a)

7b. Welding & Cutting

E. V. DAVID, SECTION EDITOR

Rail End Building up and Heat Treatment by the Arc Method. C. B. BRONSON. *Welding J., N. Y.,* Vol. 16, Jan. 1937, pp. 12-13. Practical. Former aim of max. hardness for build-up has changed to lower Brinell of 350 to 400 with greater toughness, giving less tendency for chipping out. Lowest unit cost may not be greatest economy if slightly higher unit cost produces higher quality of build-up and joint and requires reweld at less frequent intervals. Heat effect of the welding arc is shown to have no serious damaging effect on the underlying parent metal as regards tensile strength. Preheat of rail end to 600°-700° F. and reheat to same range after operation are considered necessary for preventing checking, spalling, preventing quench to high hardness and to relieve strains. Failures due to spalling have occurred when arc weld deposits were laid on old gas weld build-up not sufficiently chipped out, also when rewelds were made on cold metal. Parent metal not raised to high enough preheat develops extreme hardness in transition zone, 15 to 25 Scleroscope increase over the unaffected parent metal, and increased likelihood of spalling. Rail properly set up and maintained under average traffic conditions should give originally 8 to 10 yrs. of service before rail end build up becomes necessary. Rail end hardening by heat treatment and quench in the field or at the mill is considered to be heat treatment with poor control of the operation and the opinion is that the results obtained in rail life do not warrant the extra cost of such treatment. WB (7b)

The Welding of Pressure Vessels. JAMES CAMPBELL HODGE. *J. Amer. Soc. Naval Engrs.,* Vol. 48, Nov. 1936, pp. 498-522. Advantages of welding are enumerated as (1) elimination of limit of 2¾" thickness for successful riveting and of leakage difficulties at higher pressures, (2) elimination of limit of 2" thickness
2 of forge and hammer welded vessel, a past service hazard because of unsatisfactory testing of joint, (3) elimination of caustic embrittlement due to rivet stress, (4) weight reduction due to highest joint efficiency, etc., (5) design flexibility, more gradual stress distribution, (6) elimination of fabrication stresses by heat treatment—impossible with riveted joints. Tests on pressure vessels fabricated according to code requirements are reviewed, and show extraordinary performance in static and alternating hydrostatic tests without failure. The vessel under the latter test contained welds
3 with greater porosity than is now accepted radiographic standard. Brief discussion of classification as to design and test requirements indicates the constructional standards of the 4 or 5 major specifications and codes have a great many differences as to types of joints permitted, number of welded test plates and number of test specimens therefrom, physical properties, X-ray requirements and stress relief. Highest joint efficiency granted in any code is 95% for fully X-rayed and stress relieved, double Vee joint. The fabrication of Class I welded pressure vessels is discussed as to
4 material, preparation of plate for welding, welding and fabrication procedure, weld metal and how deposited, preparation of test plates, X-ray examination, stress relief and hydrostatic testing and final inspection. X-ray opened up the Class I pressure vessel industry to welding because of non-destructive demonstration of safety of joint after thermal stress relief. Introduction of the higher strength C steels of .35 C, .90 Mn, .25 Si with minimum of 70,000 lbs., tensile has resulted in fabrication economy, less weld thickness and more rapid X-ray inspection. Changes in welding
5 technique, higher strength weld metal with Mo addition, and X-ray and stress relief were therefore necessary as indicated by successful application of this steel up to 2⅞" thick for 30 ft. diam. Boulder Dam pipe. Slag inclusions of the sulfide type tend to weld-porosity and fissuring in fusion zone. Low alloy, high strength steels with .50% Mo or 2½% Ni are successfully welded with suitable precautions and extended use of X-rayed and stress relieved vessels is anticipated for special service conditions when official
6 approval has been granted. 4-6 Cr, ½ Mo steels are successfully welded due to temperature control (preheat) during welding and annealing treatment after welding, thus restricting them to smaller vessels which can be so treated. For welding there is a preference for ½" electrodes with mineral base coating deposited by a.c. of 350-400 amps. and 8-10 weld layers (1/8"-3/16" thick) per inch of joint thickness. Automatic welding is used by some fabricators and opinion is that good or bad welds may be obtained by either manual or automatic welding, but that with well designed equip-
7 ment the latter produced main joints of superior quality, requiring minimum removal of defects after X-raying. Curves are given for average tensile properties of thousands of specimens of Class I weld metal showing:

	Elastic Limit, lbs./in.²	Ultimate Strength, lbs./in.²	Elong., %
Average of maxima.....	53,140	71,420	38.6
Average of averages.....	48,150	63,230	29.4
Average of minima.....	41,240	56,510	22.5

8 The use of X-ray equipment for examination of joints is discussed with examples of longitudinal and transverse cracks in welds and acceptable porosity illustrated. WB (7b)

As Ye Heat Treat So Shall Ye Reap. H. M. HEYN. *Fab. Progress,* Feb. 1937, pp. 32-34. Discussion of gas furnaces for controlled atmosphere heat treating. Radiant fire tubes for muffle-type furnaces are welded with alloy steel rods and some of these tubes operate at 2000° F. A flame up to 100′ long is possible with the radiant tube for obtaining uniform heat release over en-
9 tire length. With natural gas at 40 c./1000 ft.³ a special atmosphere can be provided for 7 c./1000 ft.³ by precombustion. WB (7b)

How to Weld 29 Metals. C. H. JENNINGS (Westinghouse Elec. Mfg. Co.) *Iron Age,* Vol. 138, Dec. 24, 1936, pp. 30-35, 44-45; Dec. 31, pp. 30-35; Vol. 139, Jan. 14, 1937, pp. 27-31; Jan. 21, pp. 32-33, 101-102; Feb. 4, pp. 60-63; Feb. 11, pp. 44-47; Mar. 11, pp. 61-63. Series of articles giving detailed practical
10 information on electric arc welding several metals, including Cromansil, Man-Ten, Cor-Ten, Jal-Ten, Yoloy and R. D. S. alloy steels; wrought Fe; 18/8 and 25/12 stainless steels; stainless-clad steel, austenitic Mn steels (cast and rolled); Al; Cu; Everdur, Herculoy; Monel; Ni; bronze; brass, etc. VSP (7b)

Fusion Welding. BELA RONAY. *J. Am. Soc. Naval Engrs.*, Vol. 48, Nov. 1936, pp. 532-552. Properly welded joints require cyclic, dropwise melting of the electrode to allow arc to preheat the base metal in order that the molten metal drop from the electrode may merge in fluid state with the base. The drop-formation cycle varies with every type and brand of electrode. The local temperature of the base metal developed by the arc is dependent on thermal conductivity, mass and mass distribution, length of preheating and temperature of the base metal previous to welding. Drop frequency of base electrodes and volume of drop is dependent upon C content of electrode; former increases, latter decreases with C increase. Coated rods are responsible for prolonged drop formation time (base metal is preheated for longer time), protection of drop and preheated base by gas shield, short transfer period giving good fusion with flat, smooth bead and non-contaminated weld metal. Welding rods are selected on basis of (a) composition of base metal, (b) physical character of weld metal, (c) surface contour of joints to be welded, (d) weight of the members or wall thickness at the joint. The power sources for arc welding are discussed at length as to effect of constant potential, constant energy, constant current on melting rate, shape of the bead and ease of manipulation. A discussion of position welding, vertical and overhead indicates methods of control are in choice of electrode and that vertical downward welding should not be permitted due to entrapped slag. Non-ferrous electrodes should also not be used for other than flat, downward welding, due to absence of magnetic forces to direct the drops. Most common welding errors are listed as follows:

(A) *Too low current*—(1) lack of fusion, (2) slag inclusions (chill effect), (3) porosity (chill effect), (4) undesirable contour. (B) *Too high current*—(1) undercutting, (2) porosity (gassing), (3) low deposition efficiency (spatter loss). (C) *Too short an arc*—(1) frequent sticking of rod (unfused metal where rod is stuck), (2) rod melts too rapidly and unevenly fused. (D) *Too long an arc*—(1) undercutting, (2) porosity. Drop formation and welding methods are discussed for oxy-acetylene welding. In a discussion of the metallurgy of fusion welding it is noted that weld metal has properties superior to cast steel of similar composition due to normalized, fine grained structure of weld deposited as compared with annealed, large grained structure of the steel castings. Weld metal is normalized by the succession beads deposited in a multilayer weld if conditions of temperature are such that previous layer is not less than 200-250° F. Gas weld deposit has coarse grained structure similar to annealed steel casting. WB (7b)

Naval Welding Process Approval Tests. WILLIAM C. STEWART. *J. Amer. Soc. Naval Engrs.*, Vol. 48, Nov. 1936, pp. 553-574. The methods which the Navy uses to assure delivery of welded equipment of highest grade are discussed in detail. For important structures such as boiler drums the plant of the fabricator must pass inspection as to availability of suitable equipment. Automatic welding is required for all circumferential and longitudinal seams in boiler drums; they must also pass radiographic inspection and be stress relieved. The information as to procedures in testing is to be found in the various Navy specifications, pamphlets, etc. Process approval tests for Class A-1 pressure vessels are discussed, requirements as to tensile, impact, bend, macro, micro, chemical analysis, fatigue and corrosion fatigue are detailed. In fatigue specimen the weld seam is in region of maximum stress of the tapered test length. Process approval for welding of alloy steel castings consists of gaging a strip of the plate and filling with weld metal to determine porosity, lack of fusion, tensile, bend, impact properties and hardness survey. The Navy is interested in the welding properties of cast C-Mo steels which are in use for high pressure, high temperature steam service where creep properties are important. Physical and chemical requirements of base metal and weld for the C-Mo steels are tabulated. Tests are described and properties detailed for 4-6% Cr-0.5% Mo steels and welds. Tests for Cu-Ni alloy (6% Ni min.), corrosion resistant grade 1 steel, 25 Cr-20 Ni alloy for face and root bend tests, tensile strength, etc., are briefly described. The Navy forms required for recording tests and identifying test plates and processes are shown. WB (7b)

Discussion of Article by Messrs. Rooke, Saacke & Kugler on "Multi-Layer Oxyacetylene Pipe Welding." G. W. PLINKE & A. S. DOUGLASS. *Welding J., N. Y.*, Vol. 15, Dec. 1936, pp. 21-23. Practical. Better results (less distortion) obtained in thick pipe where a continuous bead was laid on the bottom of the V and layers of short length then laid on top. Pressure vessel welding is discussed as to methods used to prevent distortion and increase ductility by increasing acetylene in the flame above neutral requirements. For steam pipe welding for service at 650 lbs./in.^{2} and 850° F., welding layers are preferably at least three even in the thinner worked material. Cost of joint made by careful welding and chipping each bead is about $35 while other joining methods for the same joint would cost $300-$400. For the discussed article see *Metals and Alloys*, Vol. 8, May 1937, p. MA 288R/4. WB (7b)

Welded Structures. EVERETT CHAPMAN. *J. Amer. Soc. Naval Engrs.*, Vol. 48, Nov. 1936, pp. 476-483. Uniformity of parent steel plate is shown to be a necessity for successful welding and rimming steel while successfully applied to riveted construction is unsuited for reliable welded structure. The S segregation inside the rim is responsible for porosity during welding, and is interpreted during inspection as a crack or lack of fusion. The use of killed steel is recommended for welding due to the more certain inspection of the welds by X-raying. Hardenability is discussed as affecting machinability of finished structure and shop-cracking. The lack of ductility of the quenched zones near the bead, in combination with residual stresses, is responsible for cracking of welds during shop fabrication. Fool-proof welding still is considered to be one with C below .17%. Cracks are shown to be initiated also by the initially partial method of producing a butt weld, by poor penetration to root of weld, double fillet weld (illustrated with photoelastic studies). The question of thermal stresses is discussed at length and ductility of the metal as determined by tensile test shown to be inapplicable for relief of stresses in welding of large, flat plate structures. Under these conditions biaxial stresses reduce ductility and material may crack during welding operation from contraction and expansion stresses. Author stresses the desirability of perfecting design of welded structures for reliability rather than dependence upon welder qualification tests. Several photos are included which show the application of welding to large engine frames, crank case, oil couplings for diesel engine, railway engine frame. WB (7b)

A List of Fundamental Research Problems in Welding and Reviews of Recent Welding Literature. *Welding J., N. Y.*, Vol. 15, Nov. 1936, Supplement pp. 1-40. Pages 1-9 lists the problems with discussion for tests of mechanical properties, metallurgical, physics, structural, chemistry and personnel studies. Pages 9-40 give reviews of recent literature on (1) Effect of C on properties of fusion welds in steel; (2) Effect of Si on fusion welding of steel; (3) Effect of Mn on properties of fusion welds in steel; (4) Alloy steel welding, low alloy, miscellaneous, stainless and related steels, alloy steels at British Welding Symposium, elasticity modulus of austenitic welds in mild steel; (5) Non-ferrous welding, general non-ferrous and Ni welding, Zn and Pb welding, other metals, Al welding, Al welding processes, welding of Al alloys and castings; (6) Cast Fe welding; (7) Resistance welding electrodes; (8) Metal transfer in welding and allied topics, metal transfer in the arc, magnetic blow and generator characteristics, physics of the arc, gas; (9) X-ray in weld testing; (10) Weld shrinkage, theoretical and experimental, from field standpoint, shrinkage at British Welding Symposium; (11) Stress distribution in welded joints; (12) Corrosion of welds. A bibliography is given with each of above topics. WB (7b)

You're as Young as You Fabricate. GRAHAM ROHRER. *Fab. Progress*, Dec. 1936, pp. 146-148. General discussion. Welding is recommended for fabricators who wish to retain a progressive advantage in operating and marketing. Examples are given in grinding equipment fabricated by welding in Baldwin-Southwark shops for 208" astronomical mirror, die spotting machines for automotive body stamping and drawing dies and other examples of light constructions. WB (7b)

These Big Cars Go to Market. L. P. AURBACH. *Fab. Progress*, Feb. 1937, pp. 22-24. Description of development of new, lighter weight refrigerator cars by use of welding and high tensile steels. WB (7b)

Plate for the Hinges of Hell. T. F. SCHILLING. *Fab. Progress*, Dec. 1936, pp. 152-155. Descriptive of application of welding to construction of furnaces of several types. WB (7b)

Welded Boiler Drum Practice. A. J. MOSES. *Welding J., N. Y.*, Vol. 15, Nov. 1936, pages 18-21. Practical. 65,000-70,000 lb. steel of .35 C and .90% Mn up to 5" thickness are used for welded high pressure boilers welded with ¼" diam. heavy coated rod. For double butt welds a reenforcing weld layer is put on, then ground off in order to provide refined weld metal, flush with plate. X-ray requirements, stress relief, hydraulic testing are reviewed. With 400,000 volt Coolidge X-ray tubes, use of a "Bucky" diaphragm is required for sections over 3" thick for elimination of scattered radiation. Reliable radiographs are made with this outfit with 5" thick steel welds. WB (7b)

Recent Welded Boiler Drum Practice—The Commercial Aspects. E. R. FISH. *Welding J., N. Y.*, Vol. 15, Nov. 1936, pp. 21-22. Survey. Between 15 and 20 shops in U. S. A. are equipped to build welded boiler drums to code requirements. There have been no failures of code-welded boiler drums in last five years. Future weld applications are welding in of staybolts, attachment of braces for flat sections, water wall and superheater tube. WB (7b)

Economics of Welding and Cutting from a Cost Standpoint. GORDON G. HOLBROOK (Federal Shipbuilding & Dry Dock Co.) *Welding J., N. Y.*, Vol. 16, Feb. 1937, pp. 16-20. Review of history of introduction of welding into shipbuilding and present practices in ship yards. Large plate less than ¼" is subject to buckling and economy may result from use of stress relieved plate. Large number of flanged plate stiffeners in welded construction requires large hydraulic press with 24' blade for stiffeners up to 40' long. Saving in punching, shearing and planing for riveted work may be balanced by larger amount of hydraulic work for welded construction. Advantage of following erection closely with welding is that shrinkage of important members is not unduly restrained. Division of labor on welded vessels is approx. 35% tack welding, 40% welding, 15% gas cutting, 10% heating. Where vessel is light construction tack welding may run higher than 35% due to assembling difficulties with thin members. Labor cost for vertical and overhead welding is respectively 25 and 50% higher than horizontal. Riveting unit costs per rivet are increased as welding increases in partially welded ship, other costs are increased especially on light vessels. Shrinkage and stresses are discussed and practical methods of dealing with the problems and overcoming the effects are cited. WB (7b) 1 2 3

"Stove-Piping." S. C. CLARK (Linde Air Products Co.) *Welding J., N. Y.*, Vol. 16, Feb. 1937, pp. 24-25. Descriptive of method used for construction of 8" pipe line. "Wrinkle bending" of pipe described as torch heating of pipe halfway around in several narrow strips, tractors bend the pipe and heated sections bulge out to form wrinkle. WB (7b) 4

New Foreign Welding Standards. G. E. CLAUSSEN (Eng. Foundation) *Welding J., N. Y.*, Vol. 16, Feb. 1937, pp. 14-15. Abstract and translation of Dutch tentative standards. Low alloy steel with .18 C max., .04 P (Cr is excluded) is called for in welding with heavy coated electrodes. Details of tension impact, rotating bend fatigue, fillet weld test pieces are given, latter for fracture tests. Notes are included on French and British specs. WB (7b) 5

Technique for Resistance Welding Ferrous and Non-ferrous Sheet Metals. E. I. LARSEN. *Welding J., N. Y.*, Vol. 15, Dec. 1936, pp. 9-16. Unusually comprehensive review. Data on resistance welding of a variety of ferrous, non-ferrous and coated metal sheets are presented; subjects covered include: thermal effects at contacts and points, pressure, surface conditions, properties of electrode materials, properties of sheet materials, calculation of volume of metal between electrodes raised to welding heat; spot welding practice and materials that can be spot welded; heat-treatment of welds; and comparative mechanical properties of weld and parent metal for several materials. WB (7b) 6

Welding of 70,000 lb. Minimum Tensile Steel. FRED J. ESSLINGER. *Welding J., N. Y.*, Vol. 16, Jan. 1937, pp. 20-21. A general discussion of the requirements in the welding process and metal composition for successful welding of 70,000 lb. tensile steel. The difficulties are in the reduction of tensile strength of the parent metal due to heat cycle of welding when the original plate is low in impurity content (presumably C or Mn or both). Such material will show adequate strength in as received condition due to work hardening in the rolling operation, but zone of stress relief heating near weld will show greater ductility but lower strength, 2000-4000 lbs. less than requirements. The aim in welding the 70,000 lb. steel is to deposit running beads with electrodes not larger than 3/16" or 1/4" rather than full width layers with larger rods. The plate of lower impurity content than specified is shown to produce weld metal of lower impurity content than required for adequate strength because of dilution in the deposit metal of C, Mn and Mo due to mixture of molten electrode and parent metal. WB (7b) 7 8

Internal Stresses in Welded I-Beams (Eigenspannungen in geschweissten I-Trägern) E. GEROLD & H. MÜLLER-STOCK. *Arch. Eisenhüttenw.*, Vol. 10, July 1936, pp. 33-38. Original research. Internal stresses in various types of welded I-beams were determined. Beams of St.-52 with higher tensile strength had higher internal stresses than beams of St.-37, but these were not serious. Gas welding on large beams gave larger stresses than arc welding with coated electrodes, but on small beams this was reversed. The type of internal stresses in welded beams was in general similar to that in rolled beams. SE (7b) 9

Corrosion of Welds. C. J. HOLSLAG. *Welding J., N. Y.*, Vol. 16, Jan. 1937, p. 4. Brief note on personal observation of high corrosion resistance of the weld on structural steel exposed to marine, atmosphere, and boiler corrosion conditions. In the cases cited the parent metal failed in time by rusting while the welds were still intact. WB (7b) 10

Courtesy of A. B. Farquhar Co., Ltd., York, Pa.

● The rigidity of "*Shield-Arc*" welded construction is demonstrated in the case of this huge, 4000-ton corrugated plate press. Its purchasers specified that the head deflection should not exceed .006-inch.

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Fusion Welding as Applied to Frogs and Crossings. S. E. TRACY. *Welding J., N. Y.,* Vol. 16, Jan. 1937, pp. 14-16. Practical. Standard practice is to use oxyacetylene torch for welding of open hearth frogs and crossings and electric arc for Mn steel. The operations are performed in the field under traffic. The torch is used for open hearth steels, as experience has shown less damage to parent metal than with arc, as indicated by chipping, cracking or breaking of the welded parts. Ease of portability, lower investment cost are additional factors in choice of torch method. Details of when to weld and how much weld deposit to lay on are discussed from the special experience viewpoint of the track welding supervisor. Welding of Mn steel frogs and crossings is carried out with the arc because the oxyacetylene torch gave complete failure while early use of arc gave occasional encouragement. Advanced technique with arc and use of Mn-Ni rod is responsible for consistently good results now obtained. Occasional cracking of Mn steel frog or crossing casting is repaired by Veeing out, placing Mn-Ni bars in Vee and filling with weld metal. The special technique requires immediate peening of short lengths of deposit. Critical zone is parent metal just below fusion line where failure due to spalling takes place. WB (7b)

Characteristics of a Universal Welding Generator. NA'RNE F. WARD. *Welding J., N. Y.,* Vol. 15, Nov. 1936, pp. 2-7. Descriptive. Ideal generator considered to be one for constant arc energy supply, rapid voltage "build up" to re-ignite low voltage arc. Such a generator takes care of heat input requirements for thin and thick plates, non-ferrous welding and for cases where rod coating is moist. The machine built to this model is described, welding ranges determined for various loads at different field settings are given in voltage-ampere curves. Oscillograms are given to show arc behavior, indicate rapid voltage response after shorting, recovery in ¼ sec. to within 5% of open circuit voltage without current surge. Micros show type of weld deposit obtained with generator on different materials. WB (7b)

Welding and Flame Cutting as Applied to Shipbuilding in Japan. TAKEJVIO UJIIYE. *Welding J., London,* Vol. 33, Sept.-Oct. 1936, pp. 273-274, 276. Review of Japanese papers at 1936 meeting of XII Inter. Cong. Acetylene, Oxy-Acetylene Welding and Allied Ind. and discussion of wide application of arc welding, flame cutting, repairs, etc., in Japan. Brief review of research on minimizing deformation, standardization of arc welding, relation of current to plate stickiness, metallurgical and mechanical properties of stainless steel welding. A new method of welding introduced by the author consists of laying a coated electrode along the weld line, shorting the end to establish arc and allowing the arc to run along the electrode and make the deposits. Constant speed and arc are claimed and method applicable to all position welding. WB (7b)

Fatigue Strength of Welded Joints—A Review of the Literature to October 1, 1936. W. SPRARAGEN & G. E. CLAUSSEN. *Welding J., N. Y.,* Vol. 16, Jan. 1937, Supplement pp. 1-44. A complete, precise digest of the literature on the subject is presented in the form of discussion evaluating pertinent data. The data are given in tables, curves and sketches as obtained from the literature source. General conclusions are given whenever the accumulated evidence justifies them and thus is summed up the knowledge on various phases of the problem. A table of contents, a summary and a numbered list of 310 references makes the monograph a useful and handy reference for the researcher that wishes to know what has been done in the field and the welding engineer or designer that wants to know which factors in welding or design affect fatigue, etc. For review of impact tests of welded joints, see also *Metals and Alloys,* Vol. 7, Sept. 1936, p. MA 450R/8. WB (7b)

Importance of Design Control for Welded Piping Systems. T. W. GREENE. *Welding J., N. Y.,* Vol. 15, Nov. 1936, pp. 7-11. Practical. The Code for Pressure Piping permits thinner pipe to be used in weld construction than for threaded joints, permitting a saving of 17-11% for standard pipe thicknesses 2½" to 10". Operating stresses for various pressures are discussed and shown to be over 71% of yield point for large, successful installations. Stress raising factors present in nozzle openings of pipes, etc., are reviewed and hydrostatic test results tabulated. Lack of penetration, unfused areas are most effective in piping failure due to notch effect and stress concentration. Use of backing liners to assure penetration is not practical since they disturb flow of fluid or gas. WB (7b)

Modern Day Welding in the Automotive and Railway Field. J. W. MEADOWCROFT. *Welding J., N. Y.,* Vol. 15, Nov. 1936, pp. 15-17. Descriptive. Welding as practiced in Budd Manufacturing Shops is detailed. Trend toward resistance welding as major fabricating method is shown although gas and arc welding continues to large extent. WB (7b)

1 **Thermit Welding.** J. H. DEPPELER. *Welding J., N. Y.,* Vol. 15, Dec. 1936, pp. 2-8. A review is given of method of producing pure C steel or alloy steel by thermit reaction giving tensile strengths of 50,000 to 110,000 lbs./in.² Thermit welding is used principally in welding rail sections to form continuous track. Rail joints now take 45% of total track maintenance. A number of early and recent successful applications in U. S. are reviewed, with photos of completed track and method of laying long lengths of welded rail. No difficulties have been encountered on the score of expansion and contraction in service through range of temperature of 100° F. to —20° F. WB (7b)

2 **Methods of Welding Steel Rails on the Continent.** *Welding J., London,* Vol. 33, Sept.-Oct. 1936, pp. 265-266. Survey. Russian experience in butt welding rail ends by thermit process is cited as successfully obtaining 33,200 kg. for average bending load and breaking load of 57 kg./mm.² If preheat is used temperature should not exceed 600° C. at head otherwise slag is non-protective in spots and thermit metal fuses with rail steel. Swiss experience with thermit rail-end welding is entirely successful giving welding material approximately same hardness as rails and practically same wear resistance according to reports of 0 to .6 mm. wear in general in three years. Other methods used by Swiss are dissolved acetylene and the Hellerman system of electric welding, the latter being successful but costly. The electric resistance butt welding popular in Germany requires expensive equipment and gives reliable welds, but not quite equal to normal rails. WB (7b)

3 **Welding.** *Steel,* Vol. 100, Jan. 4, 1937, pp. 303-304, 306, 425-426. Presents opinions of various authorities on developments in 1936. MS (7b)

4 **Work Started on 500-Ton Mounting Structure for New 200-Inch Telescope.** *Steel,* Vol. 100, Jan. 25, 1937, pp. 40-41. Welded construction is used throughout. Yoke frame is built of hollow welded steel tubes. Special furnace was required for stress relieving. MS (7b)

5 **The Magnaflux Inspection of Pressure Vessel Welds.** JOSEPH W. YANT. *Welding J., N. Y.,* Vol. 16, Jan. 1937, pp. 5-7. Vessels are magnetized both longitudinally and circumferentially by wrapping several turns (6 to 14) of welding cable around and sending heavy current through the winding. With circumferential winding the vessel is considered sufficiently magnetized if the ends of the vessel attract small pieces of steel. Currents of 300 amps. and over are used depending upon size of vessel. When a crack is found even a strong jet of air will not remove the powder line formed at the discontinuity by the magnetized powder. Local magnetizing is sometimes used as cheaper inspection and must also be used across and parallel with the welded seam. Most readily detected crack is one which extends to metal surface, both transverse and parallel cracks can be detected. The author claims that in numerous cases for an air hardening steel the X-ray detected no cracks, but magnaflux found surface cracks 1/64 in. deep for a weld 1¾" thick. Cracks in outside fillet welds for manways are easily determined. Defects such as slag inclusions and unfused lip edges are not found by magnaflux but better testing conditions are produced by chipping off the cover beads on welded seams and chipping fillets smooth. These latter operations are considered to improve certainty in locating subsurface defects. WB (7b)

6 7 8 **Alloying Elements in Welding Rods.** A. B. KINZEL. *Metal Ind., London,* Vol. 48, June 12, 1936, pp. 667-669; *Engineering,* Vol. 141, June 19, 1936, p. 676; *Steel,* Vol. 98, June 29, 1936, pp. 49, 61. *Sheet Metal Ind.,* Vol. 10, Aug. 1936, pp. 638-640. *Welding J., N. Y.,* Vol. 15, Nov. 1936, pp. 12-14. Comprehensive review. Outlines historical steps in the development of modern welding rods for C steels, stainless steels, Cu and its alloys, and Al and its alloys, and discusses effects on the weld of Si, Mn, Ni, V, Zr, Cr, Mo, Ti, Ta, Cb, P, Zn and Sn as alloying elements in the rod. HBG + VSP + MS + AWM + WB (7b)

9 **Careful Procedure Assures Success on Bronze-welding Job.** J. C. CARTER. *Welding J. N. Y.,* Vol. 16, Jan. 1937, p. 7. Brief details of interesting repair on press frame casting. WB (7b)

10 **Pictorial Review.** A. F. DAVIS; **Welded Industrial Building.** A. L. LOW; **Hard Facing; Welding Can Take It.** *Welding J., N. Y.,* Vol. 16, Jan. 1937, pp. 9-11. Descriptive material showing applications and properties. WB (7b)

What Happens During Welding and Cutting. GEORGE V. SLOTTMAN (Air Reduction Sales Co.) *Welding J., N. Y.,* Vol. 16, Feb. 1937, pp. 9-13. Review of fundamentals and application to oxyacetylene cutting of steel and welding. WB (7b)

Designs Involving Fillet Welds. CYRIL D. JENSEN. *Welding J., N. Y.,* Vol. 16, Jan. 1937, pp. 2-4. Design considerations and discussion of simplified methods of calculating strengths of various types of fillets. WB (7b)

Whitey Sez:

"The old adage — 'A thing done right today means less trouble tomorrow' — was probably coined for the welder using his first parcel of MAURATH *electrodes."*

MAURATH, INC., CLEVELAND

BUILDER OF BETTER WELDING ELECTRODES IN ALL ANALYSES

High-Power Welding with Covered Electrodes. R. ANDERSON & M. AKESON. *Welding Journal (London),* Vol. 33, July-Aug. 1936, pages 202-204. (Reprinted from *Asea Journal).* Successful welding of 2-8 mm. unchamfered plates is described using covered electrode at high speed and amperage in a single or double pass. The rod is inclined 60-80° to the work, pointing in the direction of travel and gives penetration to middle of plate and bead builds up to only 1 mm. above the plate. In 2-pass weld another single pass on reverse side completes the seam, electrode is at same angle as before, but pointing away from direction of travel. Two-pass high speed welding is reported as successfully applied to unchamfered plates 12 mm. thick, using 6 mm. Z D electrodes and to 20 mm. thick chamfered plates. Advantages of the method are, high speed, contraction reduced to negligible amount, thus no warping results. A coarse, columnar structure is not obtained in the deposit as has been reported for the use of this method by other experimenters. The coarse structure as obtained by others was due to less intense arc which allowed longer heating period. Experiments prove rod of 5-6 mm. diameter gives max. output since further increase in diameter only results in a broader weld and does not increase welding speed or penetration. Examples of economy of method are given as 30 m./hr. (1.65 ft./min.) per single run on unchamfered plate 3/16" to ½" thick using 5-6 mm. rod and 4-4½ min. for welding together two 1 meter lengths of unchamfered ½" plate with a single run on each side using 3.7 lengths of 6 mm. ZD rod, including chipping, changing electrodes and turning over the work, but not including tack welding previous to welding. This represents a saving of 80% in time over a 4 run weld, Veed out on one side. WB (7b)

Welding in Aviation. *Welding J., London,* Vol. 33, Apr. 1936, pp. 124-125. See *Metals and Alloys,* Vol. 7, Jan. 1936, p. MA 299L/3. WB (7b)

Braze Welding a Guillotine Shear Frame. R. B. KELLER (Air Reduction Sales Co.) *Welding J., N. Y.,* Vol. 16, Feb. 1937, p. 13. Brief details plus photos. WB (7b)

Welding Works on the Railroad. J. F. HARTIN. *Ind. & Welding,* Vol. 10, Jan. 1937, pp. 17-20, 39. Review. On the railroad safety is first consideration, then economy; hence welding is applied only where equal or superior safety with some economy as competing repair method is possible. 650 different welding operations are represented on locomotive alone. WB (7b)

Discussion of Paper by W. L. Warner on "Arc Welding of Structural Alloy Steels." F. T. LLEWELLYN. *Welding J., N. Y.* Vol. 15, Dec. 1936, p. 8. Classification by W. L. Warner of weldability of steels on basis of tensile, yield strength and hardness is noted as tentative, pending comprehensive classification in which impact, fatigue and corrosion resistance are to be considered. For Warner's paper see *Metals and Alloys,* Vol. 8, Mar. 1937, p. MA 157L/5. WB (7b)

Influence of Welding on Shape in Crane Design (Einfluss des Schweissens auf die Formen im Kranbau) O. WUNDRAM. *Z. Ver. deut. Ing.,* Vol. 80, Dec. 19, 1936, pp. 1529-1530. Descriptive. Examples show simplification in design and better appearance made possible by welding. Ha (7b)

Discussion of Paper by Dr. Jacobus on "Recent Practice in Fusion Welded Boiler Drums." *Welding J., N. Y.,* Vol. 15, Dec. 1936, pp. 19-20. See *Metals and Alloys,* Vol. 8, Mar. 1937, p. MA 156L/6. WB (7b)

Report on Some Impact Tests of Fillet Welds. WENDELL F. HESS. *Welding J., N. Y.,* No. 15, Dec. 1936, pp 18-19. Original research. General discussion of results indicate three times higher impact for covered rod welds than for bare rod. Failure occurs through throat section by bending thus evaluating the depth of the throat and penetration at the root. Increase in penetration gives increased impact resistance. The test is considered to make possible determination of welders' ability. Laminated or slaggy parent metal gave low impact and peeled off in layers. WB (7b)

Annealing Treatment in Austenitic Boiler Welding (Zur Frage einer Glühbehandlung bei austenitischer Kesselschweissung) K. L. ZEYEN. *Elektroschweissung,* Vol. 7, Sept. 1936, pages 170-172. *Technische Mitteilungen Krupp,* Vol. 4, Nov. 1936, pages 162-164. While German regulations for boiler welding insist that all welds on a boiler must be annealed subsequently, those with austenitic welds were excepted from this ruling. Although austenitic welds may be annealed without trouble, repeated tests confirm that austenitic weld does not need subsequent annealing to be equivalent to other annealed welds and to relieve internal stresses, and that a tensile stress in the weld of 0.9 of that of the parent material can safely be used. 5 references. HR + Ha (7b)

Pipe Welds Are Stress Relieved by Portable Electric Heater. *Steel,* Vol. 99, Oct. 12, 1936, page 72. MS (7b)

1 **New Type of Steel Frame House Built of Sheets Spot Welded.** *Iron Age,* Vol. 138, Oct. 22, 1936, pages 42-43. Describes method developed by Arcy Corp., New York, which enables the use of mass production methods while securing flexibility of design. Unusual solidity is obtained, since entire structure is welded together, piece to piece, and contains no bolts or rivets. VSP (7b)

2 **Railway Bridge Welding in America.** *Railway Gazette,* Vol. 65, Sept. 4, 1936, pages 369-370. See *Metals and Alloys,* Vol 7, Dec. 1936, page MA 589 L/2. FPP (7b)

3 **Automatic Arc Welding Apparatus.** *Engineer,* Vol. 162, Nov. 27, 1936, pages 581-582. Illustrated article describing 3 types of apparatus. Use is made of the C-arc, bare wire or coated electrode, each type serving a distinct purpose. Automatic arc welding is practiced to a greater extent in Germany than in Great Britain. The automatic bare wire welding is frowned upon by specification authorities in England but it is used to a considerable extent in Germany for building up worn parts and for work where the demands on the seam do not call for high ductility. LFM (7b)

4 **Flash-welding Improves Rail-joints (Anwendung des Elektro-Widerstands-Pressschweissverfahrens zur Verbesserung der Eisenbahnschienenstösse)** JOHANN OTTO. *Elektroschweissung,* Vol. 8, Jan. 1937, pages 8-13. Resistance welded joints are free from differences in composition and, therefore, show no formation of grooves. The present practice is to weld two rails in the shop. New applications of resistance welding on the line are suggested. HR (7b)

5 **Electric Arc Welding of Hard Steels (Soudure à l'Arc Electrique des Aciers autres que les Aciers Doux)** F. MEUNIER & D. ROSENTHAL. *Revue de Métallurgie,* Vol. 33, Oct. 1936, pages 588-593. For steels containing more than 0.4% C cooling following welding operation might be greater than the critical quenching speed; martensitic transformation and drop of ductility or, sometimes, actual cracking due to internal strains might result. Steels of more than 0.25% C are particularly susceptible. JDG (7b)

6 **Aluminum Alloys—Their Spot and Seam Welding.** G. O. HOGLUND. *American Machinist,* Vol. 81, Jan. 13, 1937, pages 17-21. General discussion of welding properties of Al alloys and welding procedure and equipment with data on mechanical properties of Al welds. Ha (7b)

Flash-welding (Der Abbrennvorgang beim Widerstandschweissen) H. KILGER. *Elektroschweissung,* Vol. 8, Jan. 1937, pages 4-8. Practical conclusions on the consumption of energy, feed and design of machine are drawn from investigation of individual phases of preheating, flashing and pressing. HR (7b)

7 **The Hard-Facing of Oil-Well Tools.** E. W. BENTLEY. *Journal Institute of Petroleum Technologists,* Vol. 22, Nov., 1936, pages 740-746. Time and expense involved in tool renewal has led to the recently developed use of "hard-facing" alloys for oil-well drills. The following alloy materials and their applications are described: (1) stellite, a Co-Cr-W alloy, available in various grades of Br hardness between 400-625 in rod form, and applicable by either the electric arc or oxy-acetylene torch (latter preferable); (2) tungsten carbide, diamond substitutes which are not weldable (hardness 1200-2500 Br.) but are used as tool inserts, and (3) powdered WC, applicable only with the electric arc. AAA (7b)

8 **Hose Welding Rod for Arc Welding of Copper (Die Schlauch-Elektrode zum Lichtbogenschweissen von Kupfer)** A. MATTING & W. LESSEL. *Elektroschweissung,* Vol. 7, Sept. 1936, pp. 161-170. (Lichtbogenschweissung von Kupfer) A. MATTING. *Z. ver. deut. Ing.,* Vol. 80, Oct. 31, 1936, pp. 1327-1328. A rod of pure or 99% Cu, is coated with 4 layers; the 1st melts at the melting-temperature of the rod, the 2nd evolves a stream of gas, the 3rd and 4th have melting points appreciably higher than the rod. The hose formed by the two outer layers permits concentration and direction of the arc exactly on the weld. HR (7b)

9 **List of Specifications for Steel Suitable for Fusion Welding.** *Welding J., N. Y.,* Vol. 16, Jan. 1937, p. 8. List compiled by A. S. T. M., issued 1933, revised 1935. Specification numbers and titles are given. WB (7b)

10 **Welding in Construction.** GILBERT D. FISH. *Welding J., N. Y.,* Vol. 16, Feb. 1937, pp. 2-8. Comprehensive survey of types of joints used for connections in building construction and discussion of strength factors for the various welds. WB (7b)

Reclaiming Broken Parts by Thermit Welding. *Power Plant Engineering,* Vol. 40, Dec. 1936, pages 715-716. ECK (7b)

Welding of Agricultural Machinery Parts with the Oxy-acetylene Flame (Schweissen von Landmaschinenteilen mit der Azetylen-Sauerstoff-Flamme) W. RAABE. *Autogene Metallbearbeitung,* Vol. 30, Jan. 15, 1937, pages 20-22. Advantages over riveting or soldering are pointed out, and procedures described. Ha (7b)

The Assembly and Welding of Main Girders for Bridges, in the Field (Die Ausbildung und das Schweissen von Baustellenstössen geschweisster Hauptträger von Brücken) *Elektroschweissung,* Vol. 8, Jan. 1937, pages 1-4. Description of outdoor welding practice employed in erection of some railway and highway bridges in Germany is given. HR (7b)

The Welding of Magnesium Alloy Light Metals (Beitrag zur Schweissung magnesiumlegierter Leichtmetalle) F. EGGELSMANN. *Autogene Metallbearbeitung,* Vol. 29, Nov. 15, 1936, pages 337-341. In order to replace Cu (which has to be imported in Germany) an Al alloy with 0.90% Si, 0.50% Mn, 1% Mg has been introduced which at low temperatures possesses an equally great deformability and tensile strength. The latter is at 18° C. 18,500-21,300 lbs./in.^{2} with 18-20% elongation, and, at —180° C. 28,500-30,000 lbs./in.^{2} with 14% elongation. The material can be forged and welded, but the edges to be welded must be very clean, the flux should be applied immediately before welding and a "soft" flame, i.e., one with slight excess of acetylene, be used. A slag- and pore-free weld is obtained if a uniform bottom seam is first laid down. The structure is much finer than that of the parent material. See *Metals and Alloys,* Vol. 7, Dec. 1936, page MA 588R/7. Ha (7b)

Welding for "Spiralflo" Boilers. E. F. SPANNER. *The Welder,* Vol. 8, Oct. 1936, pages 1098-1100. Discussion of the necessity for good design in boiler construction in order for welder to give best performance and to limit welded sections to safe stresses. Positioning of welds with respect to lines of stress regarded as important for service of structure. It is unsafe construction when all welding must be done from one side, the aim is to close all welds by passes on reverse side. Construction of the boiler by arc welding is illustrated in photos and sketches. WB (7b)

Welding Heavy Machinery. C. A. WILLS & F. L. LINDEMUTH. *Welding Journal N. Y.,* Vol. 15, Oct. 1936, pages 72-76. Comparisons are made of the limitations imposed upon cast design by casting process such as thickness of section, shape, maximum size and material, with the advantages of weld design. The minimum amount of welding is best practice for keeping distortion and stresses at low values. Where increase in welding is required for highly stressed structures the practice of serrating the joint-edge of the plates or punching through the plates and filling with weld deposit are considered to be uncertain. The authors recommend a combination of welding and rivets for these cases. The use of composite materials in weld construction, and weight saving in welding are cited and illustrated. Peening of welds is not recommended due to uncertainty of amount of peening required or given. Stress relief by heat treatment is discussed and recommended for welding in general and especially where accurate machining is required after welding. Stress relief at 1200° F. is considered best; low rate of temp. rise to 1200° F. is required for thinner plate welded to heavier castings. WB (7b)

High Quality Filler Metal for Weld Work in the Mines (Hochwertige Zusatzstoffe für Schweissarbeiten im Bergbau) K. L. ZEYEN. *Elektroschweissung,* Vol. 7, Aug. 1936, pages 141-150. Results of tests with filler metal according to German DIN specification No. 1913. Influence of rod composition and of welding method on the mechanical properties of the weld, and effect of heat treatment on similar samples are discussed. Within the last few years the tensile strength of the welds has been raised from 65,000 to 100,000 lbs./in.^{2} and elongation from 15 to 35%. Application of high quality welds is illustrated. Hard alloys used to build up layers of high resistance to wear are Cr-Mn-Fe, Co-Cr-W, sintered or powdered W carbides, and W carbides combined with Cr-Mn-Fe alloys. HR (7b)

Oxyacetylene Process Wins Wider Recognition. H. E. ROCKEFELLER. *Steel,* Vol. 99, Nov. 9, 1936, pages 98-99, 102-103. Report covering progress in the oxyacetylene industry during the past year. MS (7b)

Influence of Elements in Steel on the Absorption of Nitrogen in Arc Welding (Influence des Éléments de l'Acier sur l'Absorption d'Azote par Fusion à l'Arc) ALBERT PORTEVIN & DIRAN SÉFÉRIAN. *Comptes Rendus,* Vol. 204, Jan. 4, 1937, pages 48-51. The presence of Mo, Zr or Cr tends to increase the absorption of N_2 during arc welding. FHC (7b)

The Repair of Steel Castings by Welding. HUGO W. HIEMKE. *J. Amer. Soc. Naval Engs.,* Vol. 48, Nov. 1936, pp. 484-497. Descriptive. Former methods of surface inspection, machining and hydrostatic tests are now supplanted by X-ray or gamma-ray inspection to locate defects of various types. For naval service with increased temperatures and stresses in service it is necessary to determine that defects in castings have been satisfactorily avoided or repaired. Location of defects is assured by X- or gamma-ray and extent of defect indicated by comparison with standard Navy films. A limit is placed on repair by welding of defects which do not reduce wall thickness by more than 25%, the repair being required to pass inspection on re-radiographing. Exceptions to this 25% rule may be made in justified cases passed upon by the Navy. "Ordinarily, the use of radiography has been the means of salvaging castings, rather than the means of rejection." Repair welds are found to be more sound that the casting itself. A review is made of the Navy's standard radiographic films for various types of defect and photos are given which indicate the correlation of radiographic film with the actual defect as opened up by machining. Radiographs are given of defective areas before and after welding. The distortion caused by welding stresses and relief of stress by heat treatment are reviewed and data presented in curves showing effect of time on residual stress remaining in material held at various stress relieving temperatures. Stress relief of casting for 4 hrs. at 900° F. was found practicable with low magnitude of distortion produced if welding is of good grade and casting is supported during heat treatment. Advantages and disadvantages of X- and gamma-ray are cited; former has greater sensitivity in sections up to 2" and films made with latter on varying cross section show better contrast. WB (7b)

Special Welding Technique Required in Process for Cladding Steel Rolls. *Steel,* Vol. 99, Nov. 9, 1936, pages 45-46. Describes practice of Youngstown Welding & Engineering Co., Youngstown, O., in covering steel rolls with corrosion-resisting metals, usually Monel Metal. MS (7b)

Welding and Fabricating. RALPH MILLER. *Iron Age,* Vol. 139, Jan. 7, 1937, pages 564-568, 570, 572-574, 576-580. Increased use of welding and cutting the past year is indicated by the increased sale of equipment and supplies, broader acceptance of cutting and welding by regulatory bodies in codes and specifications, better understanding of the application of welding by designers, and comprehensive metallurgical study and acceptance. VSP (7b)

Welded Pressure Vessels. A. J. MOSES. *Steel,* Vol. 99, Dec. 14, 1936, pages 32-35, 60. Describes practice of Hedges-Walsh-Weidner Co., Chattanooga, Tenn., in fabricating welded pressure vessels with wall thicknesses up to 5 in., the maximum with existing inspection methods. Uses 3 types of steel, 2 being modified C steels having C limited to 0.35% and Mn to 0.90%. Third is now being used for first time in welded boiler drums and contains 0.20% C, 0.60% Mn, and 0.50% Mo with a minimum tensile strength at room temperature of 70,000 lbs./in.^{2}, high creep value, toughness, and good weldability. MS (7b)

Welds Replace Keys; Endurance Limit of Ringwelds to Shearstress (Ersatz von Keilbefestigungen durch Schweissungen; Dauerfestigkeit von Ringnähaten bei Scherbeanspruchungen) L. v. ROESZLER. *Elektroschweissung,* Vol. 7, Nov. 1936, pages 209-215. Advantages and disadvantages of welding in the replacement of keys are discussed, welds of relatively small area being sufficient. The static and dynamic strength of small ringwelds is determined. Based on the results, data for permissible stresses are proposed. HR (7b)

Autogenous Welding of Pure Aluminum and Its Importance for the Construction of Chemical Apparatus (Autogenschweissung des Aluminiums und ihre Bedeutung für den chemischen Apparatebau) F. ZIMMERMAN. *Autogene Metallbearbeitung,* Vol. 30, Jan. 1, 1937, pages 2-11. Recent experiments are described which show that hammering while still warm increases the tensile strength almost to that of the parent material. Cold-hammering should be avoided. Correct shapes of joints to be welded are illustrated. Ha (7b)

Electric Welding Processes (Die elektrischen Schweissverfahren) O. ZORALEK. *Elektrotechnische Zeitschrift,* Vol. 57, Oct. 1, 1936, pages 1148-1151. General summary. Ha (7b)

A Discussion of Automatic and Manual Electric Arc Welding. A. J. MOSES. *J. Amer. Soc. Naval Engs.,* Vol. 48, Nov. 1936, pp. 523-531. The successful use of automatic welding is considered to be very limited and to produce welds of no higher quality than manual welds by properly qualified operator. WB (7b)

How to Install Linings of Stainless-clad Steel in Tanks and Kettles. W. B. KEELOR. *Steel*, Vol. 100, Feb. 1, 1937, pages 64-65. Practical. Describes low-cost procedure for applying linings by electric arc welding. MS (7b)

Welding Changes the Air of Industry. M. S. KICE, JR. *Ind. & Welding*, Vol. 9, Nov. 1936, pp. 23-28. Application of welding to blower and fan construction is discussed. See *Metals and Alloys*, Vol. 8, Mar. 1937, p. MA 154R/6. WB (7b)

A Weldable High Tensile Structural Steel. E. C. HOUSTON. *Welder*, Vol. 8, Nov. 1936, pp. 1126-1130. Practical. The low alloy, high tensile steel "Ducol" developed by Colvilles Ltd., over 15 years ago has a tensile strength of about 43 tons/in.^{2}, and is shown to be weldable with suitable precautions. It is more sensitive than mild steel to bend-cracking at sheared edges and to quench effect in welding. Murex "Special D" electrode is recommended for high strength weld. Some hardness surveys are given in macrographs of single bead welds on one side of a chilled plate and on reverse side after completion of first run. Maximum hardness (Vickers) of chilled side was 460-470 Brinell and 325 for second run, showing necessity for removing chill from plates in cold weather and for higher preheat of thicker sections to be welded. Physical properties of Ducol welded with Murex "Special D" rods are given in table showing good bend ductility and high strength. Steels are of 1-1.5% Cr or Mn with .5% Ni or Cu. Several large welded structures are shown. WB (7b)

Hard-surfacing Opportunities in the Job Shop. FRED G. HUFFMAN. *Ind. & Welding*, Vol. 10, Jan. 1937, pp. 34-35, 38. For hard surfacing plowshares the ability of hardfacing to hot work after heating in forge fire is important item. Hardfacing may be applied to thresher parts, corn shellers, trenching and digging equipment and on chain links. WB (7b)

Design for Minimum Welding Costs. C. H. JENNINGS. *Ind. & Welding*, Vol. 10, Jan. 1937, pp. 31-33. Practical. Ideal welded structure has fewest possible parts joined with minimum of weld metal. Bending of plate for shapes is considered good practice to reduce welding operations and eliminate corner welds. Double D and Vee type joints recommended for all plate ¾ in. or over if welding from both sides is possible because of lower distortion and reduction in amount of weld metal required. Up to 1 in. thickness the speed of welding is the same for double V or Vee. In fillet welding 4 times as much weld metal is required to double the fillet size. Fillet size for plate of increasing thickness, spacing of fillets for intermittent welding, welding stresses, and stress relief are discussed. WB (7b)

Louis Pasteur Showed Us the Way. J. E. HALL. *Fab. Progress*, Dec. 1936, pp. 130-132. Brief review of hospital equipment of welded stainless steel and Monel. Welds are ground flush and polished. Advantages over former electroplated equipment are permanency, corrosion resistance, fine appearance. Welded equipment makes for easy cleaning and sterile conditions. WB (7b)

Fluxes—Their Function in Metallic Arc Welding. D. J. MATHIAS. *Foote-Prints*, Vol. 9, Dec. 1936, pp. 1-12. A brief discussion is given of the evolution of the welding electrode from bare to coated rod. Transfer of molten metal is shown to be different for bare rod than for coated rod and arc for latter is more stable due to presence of fluxes which have ability to emit electrons. Position of flux material in electrochemical series and chemical activity are related to efficiency of coating in promoting stable arc. An example is given of light flux coating on 3/16" diam. rod using 190 amps. and giving a melting rate of 25 g. and 53 g./min., respectively for flux of $CaCO_3$-TiO_2. By proportioning these two materials it is possible to obtain any melting rate and penetration between the above. The heavy coated electrode introduced by Kjellberg (1907) was first attempt to exclude air atmosphere in welding and produce welds with low O and N contents. Today the trend is toward the combination of the advantages of both mineral (slag producing) and organic (gas producing) electrodes thus producing modern electrode of highly satisfactory characteristics. Tables are given to show the effectiveness of the coating in preventing air contamination as indicated by the lower O and N, and higher C and Mn contents of deposit as compared with bare rod deposit. The advantages are shown also in table of physical properties. WB (7b)

Ten Years of Welding Development. NORMAN L. MOCHEL. *J. Amer. Soc. Naval Eng.*, Vol. 48, Nov. 1936, pp. 455-475. A review of successful applications of torch and arc welding to structures of diverse types. Attention is centered on construction of mechanical and electrical equipment on board ship in which field the electric arc is predominant. For this field the trend is shown to be toward heavy-coated electrodes with electrodes produced specifically for various types of welding. WB (7b)

Progress in Pipeline Welding. T. R. JONES. *Intern. Acetylene Assoc.*, Preprint, Nov. 1936, 12 pp. *Welding Engr.*, Vol. 22, Jan. 1937, pp. 30-33. Review of past history in the progress of welding with discussion of present practice in laying a line. 1 Organization of crew is into three groups, line up and tack welding, welding, laying of pipe. Pipe is turned while welding and high welding speed used on bell-hole welds. The single V butt weld is favored for gas-welded lines. Chill ring liners for arc — welding decrease costs considerably but for gas welding the chill ring method is not always most acceptable and economical and represents a penalty on gas welding for the larger size pipe. WB (7b)

2 **The Gas Welding of Cupro-nickels and Copper Silicon Alloys.** I. T. HOOK (American Brass Co.) *Intern. Acetylene Assoc.*, Nov. 1936, 16 p. reprint. **Oxy-acetylene Welding of Copper-silicon Alloys.** IBID. *Ind. & Welding*, Vol. 10, Jan. 1937, pp. 61-63. — History of introduction and development of the alloys is reviewed including Cu-Ni and Cu-Si the latter with Mn or Zn and Sn additions. Welding properties, procedure and fluxing are discussed for each group of alloys. Hot shortness of the alloys can 3 prevent production of good weld if precautions as outlined for procedure are not followed. Excellent welds obtained in Cu-Ni with proper procedure and flux, with stresses reduced by jigs, and flame temperature and composition regulated to prevent deoxidation of protecting additions in the rod. It is consid- — ered that with the use of proper procedure the rod or strip may be identical in composition with the parent metal, but others in the literature prefer "special" rods having additions of Mg, excess Si, etc., for hindering CO absorption, formation of protective slag film, 4 respectively. Discussion of Cu-Si alloys reviews their properties and outlines the welding procedure and precautions as above for Cu-Ni. Includes bibliography. See also *Metals and Alloys*, Vol. 8, Mar. 1937, p. MA 154L/9. WB (7b)

— **When Plate Meets Plate.** CYRIL J. BATH. *Fab. Progress*, Dec. 1936, pp. 149-151. Discussion of press brakes and use of welding in their construction. The use of the brake for bending shapes cut fabrication costs by reducing welding to minimum. 5 Evolution of fool-proof brake with unbreakable frame became possible by use of welding. Frame was made more than twice as stiff in resistance to deflection due to rigid continuous structure obtained by welding frame, bed, housings and crown into one unit. Lower deflection keeps warp and bearings aligned and prevents — jamming. WB (7b)

Welding Applied to Reinforced-concrete Structures. O. BONDY. *Welding Engr.*, Vol. 21, Nov. 1936, pp. 24-27. Survey. 6 Methods in use in Europe for strengthening concrete construction by welding reinforcing wire, and details of welding methods are given. WB (7b)

— **Welding 3.5% Nickel Steel.** EDWARD J. BRADY. *Welding Engr.*, Vol. 21, Dec. 1936, pp. 31-32. Practical. Use of slight preheat, and also of reversed polarity and rod giving deposit of slightly lower Ni and C are recommended to prevent cracking during welding. Discussion given of precautions used in weld- 7 ing of 2, 3½, 5% Ni steels in various thicknesses. WB (7b)

— **Welding Dissimilar Metals.** F. G. FLOCKE & J. C. SCHOENER. *Ind. & Welding*, Vol. 10, Jan. 1937, pp. 64-67. Practical. For welding Ni to Fe (3/16 in. and over) the scarfed edge of the Fe is first overlaid with layer of Ni deposited on the plate by fusion welding, then the weld is made to the Ni plate. Welding Monel metal to Fe is illustrated with micros and macros of the bond, tabulated results of tensile, bend, welder qualification, chemical 8 analysis, hardness survey tests. Results on a few high strength Monel welds are given. WB (7b)

— **Nickel-copper High-strength Steels Meet Specifications of Welded Construction.** A. E. GIBSON. *Steel*, Vol. 100, Jan. 25, 1937, pp. 34-39. Deals with properties of low-alloy Ni-Cu steels for welding. Their air-hardening property is low, they have the highest elastic ratio of any of the commercially produced low- 9 alloy steels, possess high impact value, and offer no complication in welding with either low-C or alloyed electrodes. Results of tests tabulated. MS (7b)

— **Welding the Studebaker Body.** EARL B. RAUSCH (Studebaker Corp.) *Welding Engr.*, Vol. 22, Feb. 1937, pp. 34-36. Description, discussion of body, frame, etc., welds. Resistance welding is most important application. WB (7b)

10 **Internal Stresses in Welding.** LEWIS REEVE. *Welding Ind., London*, Vol. 4, Oct. 1936, pp. 344-355; Discussion, Nov. 1936, pp. 391-395. Review of the literature with discussion of the methods of measuring stress and results obtained by various authors. WB (7b)

8. FINISHING

H. S. RAWDON, SECTION EDITOR

Manual Operations Still Predominate in Surface Finishing of Bicycles. *Steel,* Vol. 99, Oct. 5, 1936, pages 47, 50-51. Describes some of the processes followed at the plant of the Shelby Cycle Co., Shelby, O. MS (8)

Metal Finishing. HERBERT R. SIMONDS. *Iron Age,* Vol. 139, Jan. 7, 1937, pages 635-638, 640, 642, 644; Jan. 14, 1937, pages 37-43, 52. Discusses the progress made in the past year in electroplating, lacquers and paints, rustproofing, cleaning and special finishes as well as in equipment used. VSP (8)

8e. Metallic Coatings other than Electroplating

Little Applications. *The Metallizer,* Vol. 5, Aug.-Sept., 1936, pages 3,13. A custom metallizing shop in Edmonton, Alberta, Canada, has reported metal spraying equipment to be especially applicable for restoring press fits to loose end bearings. Important savings are cited by metal spraying P-bronze onto the bronze bushings in the hub of sleeves of variable pitch aeroplane propellers and in building up worn motor parts. BWG (8e)

8f. Non-Metallic Coatings

Manufacture and Properties of Enameling Iron. KARL KAUTZ. *Ceramic Industry,* Vol. 27, Part I, Sept. 1936, pages 179-181; Part II, Oct. 1936, pages 221-262, 298. Part I is a general consideration of the manufacture of enameling sheet and covers the fabrication, heat treatment, pickling, cold rolling and leveling operations. Part II lists the defects found in enameling sheet and briefly discusses its properties, specifications and deep drawing operations. PCR (8f)

Microscope Determines Suitability of Steel Surfaces Preparatory to Finishing. HAROLD ALLEN. *Steel,* Vol. 99, Nov. 2, 1936, pages 58, 60. For satisfactory adhesion of synthetic type enamel to steel sheets, metal surface should show under microscope at 30 diam. magnification, a deep, evenly distributed toothy condition. MS (8f)

Exposure Tests on Architectural Porcelain Enamels. M. G. AMMON. *The Enamelist,* Vol. 14, Dec. 1936, pages 7, 59. According to tests in which enameled panels were exposed to the atmosphere for 4 yrs., the glossy acid-resisting enamels and the high-fired sign enamels are generally the best for architectural purposes. Matte finish non-acid resisting enamels weather badly. PCR (8f)

Coloring of Aluminum and its Alloys with Inorganic Substances on MBV-Basis (Das Farben von Aluminium und seinen Legierungen mit anorganischen Stoffen auf MBV-Grundlage) W. HELLING & H. NEUNZIG. *Aluminium,* Vol. 18, Dec. 1936, pages 608-617. The coloring of Al by oxidation with "MBV solution" is described. Stable brown colors were obtained by treatment with $KMnO_4$ or with heavy metal nitrates in HNO_3-permanganate mixtures. Cu nitrate in HNO_3 solution produces yellow to black, Co nitrate deep-black colors. Impregnation of the film with a paraffin wax mixture or a transparent lacquer is necessary to make it resistant to corrosion from perspiration. A table gives complete information on baths, colors, treatment, resistance to light, weather and corrosive substances. Ha (8f)

Automatic Spraying of Porcelain Enamel Speeds Production, Cuts Costs. *Steel,* Vol. 99, Dec. 14, 1936, pages 50, 52. Describes new spraying machine installed in plant of Edison General Electric Appliance Co., Chicago. Most of ware produced is covered with a "one-cover" coat sprayed at 35 g./ft.^{2} MS (8f)

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9. TESTING

Determination of the Gases in Steel by the Vacuum Fusion Method (Neuere Untersuchungen des Heisextraktionsverfahrens zur Bestimmung der Gase im Stahl) G. THANHEISER. *Stahl und Eisen,* Vol. 56, Sept. 17, 1936, pages 1125-1132. In English and German. See *Metals and Alloys,* Vol. 8, Apr. 1937, page MA 206R/8. SE (9)

The Research and Development Department Laboratory of the Mond Nickel Co., Ltd. *Foundry Trade Journal,* Vol. 55, Oct. 22, 1936, pages 307-309. Description, illustrated with several photographs. AIK (9)

9a. Inspection & Defects, including X-Ray Inspection

C. S. BARRETT, SECTION EDITOR

Local Martensite Formation in Steel Wire (Oertliche Martensitbildung bei Stahldraht) W. PÜNGEL. *Stahl u. Eisen,* Vol. 57, Apr. 8, 1937, pp. 373-374. Martensitic spots and resultant cracks on the surface of a wire cable had evidently been caused by rubbing on the shaft. In rubbing the temperature was raised high enough to give martensite on subsequent cooling. SE (9a)

Investigation of Grain Size and Roughness by Means of Electron Interferences (Strukturuntersuchungen über Rauhigkeit und Korngrösse mittels Elektroninterferenzen) W. PAPSDORF. (Inst. Tech. Physik. Univ. Köln) *Ann. Physik,* Vol. 28, Mar. 1937, pp. 555-567. The structure of thin surface layers is examined to much better effect by electron ray instead of cathode ray interferences. The method is described in detail and results on thin Ag layers of 30 mu described. If the surface is smooth no interference maxima can be observed. Ha (9a)

9b. Physical & Mechanical Testing

W. A. TUCKER, SECTION EDITOR

2 **Impact Strength and Notch Sensitivity of Cast Iron (Ueber die Schlagfestigkeit und Kerbempfindlichkeit des Gusseisens)** E. PIWOWARSKY. *Giesserei,* Vol. 23, Dec. 18, 1936, pp. 674-685. Correct determination of dynamic properties is difficult because the volume affected is an important factor. Tests are described which show that the impact strength of cast Fe is related to the shape and length of the specimen. Cast specimens of less than 1 cm.^{2} should not be used for this test. The velocity of the impact affects the observed value of impact strength; the casting skin has no particular effect. Low C content and suitable thermal treatment 3 provide cast Fe of high impact toughness. The notch-toughness of cast Fe increases with the quality of the material. 16 references. Ha (9b)

Comparative Tests of Small Notched-bar Specimens of Varying Notch Depth and Cross-section (Vergleichsversuche an kleinen Kerbschlagproben, mit Verschiedenen Kerbtiefen und-durchmessern) R. MAILÄNDER. *Arch. Eisenhüttenw.,* Vol. 10, Aug. 1936, pp. 53-58. Original research. Tests of 10 x 10 mm. 4 specimens of 3 steels were made using 2, 3, and 5 mm. deep notches. The results are shown in tables and curves indicating the values obtained and the amount of scatter. No conclusions were drawn as to which notch is preferable. **Relation Between Static and Dynamic Notched-bar Tests (Verhältnis der Ergebnisse von statischen und dynamischen Kerbbiegeversuchen zueinander)** *Ibid.,* Sept. 1936, pp. 109-110. Notched-bars of Thomas, Al and Si killed steels were tested statically by bending and dynamically by impact. In the region of sharp drop in energy absorption the 5 static tests gave somewhat higher values than the dynamic. At higher temperatures where the energy absorption increased the dynamic tests gave higher values. SE (9b)

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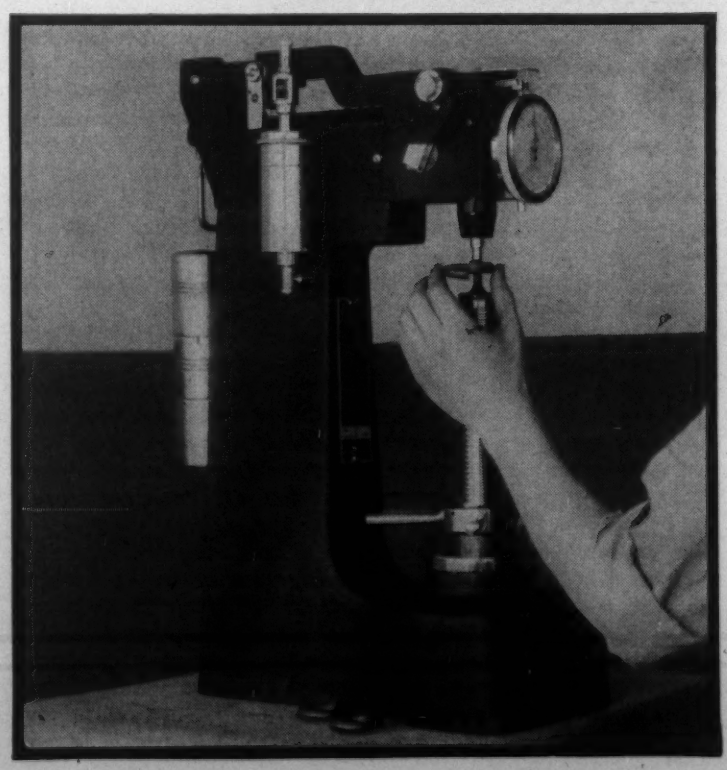

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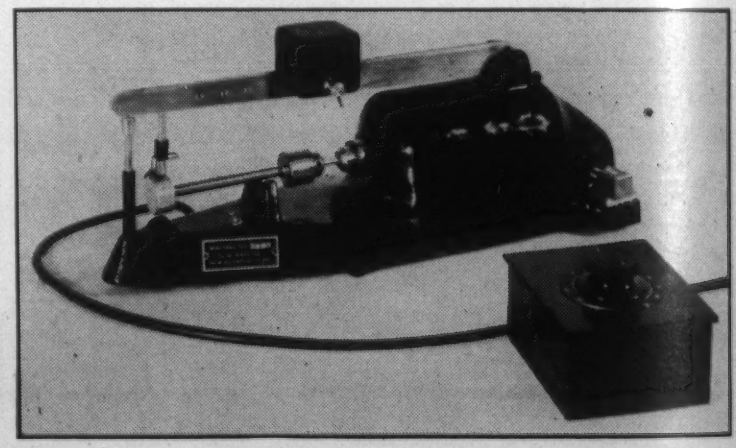

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A Simple Method for Determining the Thermal Conductivity of Metals (Ein einfaches Verfahren zur Messung der Wärmeleitfahigkeit von Metallen) FRITZ GABLER. *Physik. Z.*, Vol. 38, Feb. 1, 1937, pp. 78-82. Descriptive. The integration of the differential equation of heat conductivity is given for the state of inertia whereby the temperature relation of the specific electrical resistance and heat transfer number are taken into account. Based on this derivation, a method for determining the heat transfer number and the thermal conductivity k of metals is developed. An accuracy of 1% is claimed and tests on Cu (10-15° C.) and Ni bars (12-25° C.) are reported. The method is also useful at elevated temperatures. EF (9b)

Electrical-heating, Electrical-resistance and Electric-furnace Alloys, Report of A. S. T. M. Committee B-4. DEAN HARVEY, Chairman. *Proc. Amer. Soc. Testing Materials,* Vol. 36, Pt. 1, 1936, pp. 157-161. Progress report and proposed changes in standards. **Appendix. Proposed Method for the Bend Testing of Wire,** pp. 162-167. The method proposed is intended to evaluate the resistance to bending of wire from about 0.010 to 0.117 in. in diam. The test consists in clamping the specimen rigidly at one end, subjecting the wire to a bending force and measuring the resulting permanent angular deflection. The bending force may be produced by the following: (a) the impact of a freely falling pendulum; (b) a bending moment applied by means of a weighted arm which maintains contact with the specimen during the bending operation; and (c) an accurately predetermined bending moment applied by a manually operated mechanism. Specific directions are given. See also *Metals and Alloys,* Vol. 7, July 1936, p. MA 378L/9. VVK (9b)

High-velocity Tension-impact Tests. H. C. MANN. *Proc. Am. Soc. Testing Materials,* Vol. 36, Pt. II, 1936, pp. 85-97; discussion, pp. 98-109. Original research. Data are presented which definitely show that high-velocity tests are essential to reveal the true dynamic properties of materials. The results obtained further indicate that in the selection of materials for use under conditions involving dynamic loading the following 3 significant factors must be considered: (1) the transition velocity within which normal material behavior may be expected; (2) the ratio of total energy value to mass or volume of material involved; (3) the effect of surface irregularities such as tool marks, size and form of fillets, etc. The high-velocity tension-impact machine designed and built for this investigation is described, and the mathematical derivation of the equation used to calculate the energy required for rupture is given. Diagrams and photographs of typical fracture transitions are presented, showing the effect of velocity on both ferrous and non-ferrous materials. See also *Metals and Alloys,* Vol. 7, May 1936, p. MA 250R/1. VVK (9b)

The Interpretation of Creep Tests. FRITZ GENTNER. *Metal Treatment,* Vol. 2; Autumn, 1936, pp. 148-154. See *Metals and Alloys,* Vol. 7, July 1936, p. MA 369R/4. JCC (9b)

Development of Measuring Methods in Metallography (Entwicklung der Messverfahren in der Metallkunde) E. SCHEIL. *Z. Ver. deut. Ing.,* Vol. 80, Nov. 28, 1936, pp. 1466-1468. Review; 12 references. Ha (9b)

Slow-bend and Impact Tests of Notched Bars at Low Temperatures. H. F. MOORE, H. B. WISHART & S. W. LYON. *Proc. Am. Soc. Testing Materials,* Vol. 36, Pt. II, 1936, pp. 110-115; discussion 116-117. See *Metals and Alloys,* Vol. 7, Dec. 1936, p. MA 601R/6. VVK (9b)

Ductility Testing of Aluminum and Aluminum Alloy Sheet. R. L. TEMPLIN. *Proc. Am. Soc. Testing Materials,* Vol. 36, Pt. II, 1936, pp. 239-248. With discussion. See *Metals and Alloys,* Vol. 7, Dec. 1936, p. MA 603L/2. VVK (9b)

A Hardness Tester for Microscopical Objects. E. M. H. LIPS & J. SAUK. *Nature,* Vol. 138, Aug. 22, 1936, page 328. A Vickers diamond point is attached to a microscope so it can be swung on the revolving head of the microscope at the center of field of vision and pressed into the metallographic specimen with a weight of about 35 gms. The diagonal dimension of the impression gives the hardness (expressible as the visual Vickers numerals). Gives a rapid and convenient measure of hardness of micro-constituents. CSB (9b)

Effect of Test Conditions on the Results of Brinell Hardness Tests of Cast Iron (Einfluss der Prüfbedingungen auf das Ergebnis der Brinellhärteprüfung von Gusseisen) H. REININGER. *Arch. Eisenhüttenw.,* Vol. 10, July 1936, pp. 29-31. 1000 tests of machine and cylinder cast Fe gave somewhat lower Brinell hardness numbers with a 5 mm. ball than with a 10 mm. ball; the smaller ball also gave more scatter—no doubt because of variations in the amount, size, and distribution of the graphite flakes. SE (9b)

Appearance of Flow Lines in Making Stress Measurements by J. Mathar's Method (Fliesserscheinungen beim Spannungsmessverfahren nach J. Mathar) G. MESMER. *Arch. Eisenhüttenw.,* Vol. 10, Aug. 1936, pp. 59-63. On drilling strained plates stress concentrations around the hole increase as much as 50%, this being great enough to produce a flow pattern as revealed by Fry etching. Similar flow figures were obtained around drilled holes at welded seams. SE (9b)

9c. Fatigue Testing

H. F. MOORE, SECTION EDITOR

The abstracts appearing under this heading are prepared in cooperation with the A.S.T.M. Research Committee on Fatigue of Metals. The purpose of this cooperation is to make readily available complete references to the literature of this subject. The Committee does not necessarily subscribe to the statements of either the author or the abstractor.

Strength and Elastic Properties of Cast Iron. J. W. DONALDSON. *Foundry Trade Journal,* Vol. 55, Oct. 29, pages 338, 342. See *Metals and Alloys,* Vol. 7, Dec. 1936, p. MA 603R/6. AIK (9c)

9d. Magnetic Testing

L. S. REID, SECTION EDITOR

Non-destructive Testing of Railway Car Wheels and Axles for Surface Cracks (Zerstörungsfreie Untersuchung von Radsätzen auf Anbrüche) KÖNIG. *Organ Fortschr. Eisenbahnw.,* Vol. 91, Dec. 15, 1936, pp. 504-509. Original research. Two testing methods (electrical and electromagnetic) and testing results on inspection of railroad vehicle wheels and axles are discussed. In actual practice on the German State Railroad, both methods are applied successively to the same object. EF (9d)

9e. Spectrography

L. W. STROCK, SECTION EDITOR

Spectrographic Quantitative Analysis of Aluminum and its Alloys. A. R. STRIGANOV. *Legkie Metal.,* Vol. 5, July 1936, pp. 20-28. In Russian. General review. HWR (9e)

The Spectroscopic Analysis of Tin. R. M. SMITH (Brit. Nonferrous Metals Research Assoc.) *Tech. Pub. Intern. Tin Research Development Council,* Series A, No. 46, Nov. 1936, 26 pp. Review plus original research. Arc and spark methods were investigated for quantitative determination of Al, Cd and Zn in Sn over the range of 0.001 to 1.0%. Spark spectra made under standard conditions are recommended for routine determinations of Al, Cd and Zn, using the "internal standard" method. For comparison with selected standard alloys, specially purified electrolytic tin is advocated. Tables are given of wave length of sensitive lines made by impurities in tin and notes are given on their identification. BWG (9e)

The Polarization Photometer LEIFO and Its Application for the Silicon Determination in the Foundry Laboratory (Das Polarisationsphotometer LEIFO und seine Anwendung bei der Siliziumbestimmung im Giessereilaboratorium) H. FREUND, K. DIETRICH & SCHMITT. *Giesserei,* Vol. 24, Jan. 29, 1937, pp. 61-63. The instrument and measuring method which uses a solution to be determined and a standard solution, are described. Ha (9e)

On the Quantitative Spectrum Determination of the Alloying Elements (Beiträge zur quantitativen spektralanalytischen Bestimmung von Legierungsbestandteilen) O. SCHLIESSMANN & K. ZÄNKER. *Arch. Eisenhüttenw.,* Vol. 10, Feb. 1937, pp. 345-352. The spark spectrograph and method of operation are described for the spectrographic analysis for Si, Mn, and other alloying elements in iron and steel. For C more accurate results were obtained by sparking in a H_2 atmosphere. The results showed a variation from the mean of about 12%. **The Quantitative Spectrographic Determination of Carbon, Silicon, Manganese, Nickel, Chromium, and Molybdenum in Iron and Steel (Die quantitative spektrographische Bestimmung von Kohlenstoff, Silizium, Mangan, Nickel, Chrom und Molybdän in Eisen und Stahl)** *Idem.,* Mar. 1937, pp. 383-394. The apparatus and method of spectrum analysis are described and the lines used for quantitatively determining Si, Mn, Ni, Cr, and Mo in alloy steels are shown along with sample results. C can also be determined semi-quantitatively. The precision may be within ±5% and satisfactory agreement with chemical analysis was obtained. SE (9e)

10. METALLOGRAPHY

J. S. MARSH, SECTION EDITOR

Oxide Layer on a Polished Copper Surface. S. DOBINSKI. *Nature,* Vol. 138, July 4, 1936, page 31. An electron diffraction study of the so-called "amorphous layer" induced by polishing metals, which yields broad diffraction halos corresponding to spacings of 2.25 A.U. and 1.28 A.U. ± 5% regardless of the metal. Confirms previous work for Cu polished in air, but finds that Cu polished under benzene and under pentane gives different rings (corresponding to 1.91 A.U. and 1.16 A.U.), which revert to the former type after exposure to air. Concludes, therefore, that the blurred rings from polishing in air are diffuse spectra from Cu_2O. The special properties observed of polished copper surfaces may thus be due to oxidation instead of amorphous metal. A similar situation is expected with other metals. CSB (10)

The Beilby Layer on Non-Metals. G. I. FINCH. *Nature,* Vol. 138, December 12, 1936, page 1011. Electron diffraction of minerals after polishing indicates an amorphous (Beilby) layer in some instances, a crystalline layer in others. Believes that the latter cases are the result of recrystallization of the amorphous layer. Etching restores crystalline patterns in all cases. Halo patterns from carborundum are ascribed to superficial oxidation during cooling of the charge; this is a rebuttal to Germer's contention that the halos may be misinterpreted and may not prove a Beilby layer. CSB (10)

Oxide Layer on a Polished Copper Surface. L. H. COLLENDAR. *Nature,* Vol. 138, Aug. 15, 1936, page 291. The initial solution potential of Al when polished under paraffin, benzene, and water indicates that many observations on the so-called "amorphous" layer may really have been observations on the properties of the oxide film formed during polishing. CSB (10)

Surface of Copper Formed on Solidification in Vacuo. S. DOBINSKI & C. F. ELAM. *Nature,* Vol. 138, Oct. 17, 1937, page 685. Electron-diffraction study of the high-purity Cu solidified in vacuum showed a surface layer of crystals all having (111) or (100) planes parallel to the surface although X-ray reflections showed differing orientations for the underlying grains. Ag behaved similarly. May be related to surface tension, and may explain the fact that the first layer of Cu_2O formed on polycrystalline Cu has (111) directions normal to the surface. CSB (10)

Recognition of Crystal Symmetry by the Observation of Polarization Colors through Crossed Nicols (Beitrag zur Erkennung der Kristallsymmetrie durch Beobachtung der Polarisationsfarben zwischen gekreuzten Nikols) M. VON SCHWARZ & H. DASCHNER (Munich) *Z. Metallkunde,* Vol. 28, Nov. 1936, pp. 343-346. Theoretical and descriptive. The fundamental optical theory for the change of color in reflected polarized light is developed. The experimental technique is described for determining whether an opaque crystal is optically isotropic or has one or two axes of symmetry. GD (10)

The Utility of Polarized Light in the Metallography of Iron and Steel (Die Verwendbarkeit polarisierten Lichtes bei der Gefügeuntersuchung von Eisen und Stahl) P. SCHAFMEISTER & G. MOLL. *Arch. Eisenhüttenw.,* Vol. 10, Oct. 1936, pp. 155-160; *Tech. Mitt. Krupp,* Vol. 5, Feb. 1937, pp. 9-16. The appearance of various types of sulphide and silicate inclusions and such constituents as carbides, nitrides, and graphite under ordinary and polarized light are discussed and illustrated. Polarized light may frequently aid in identifying doubtful constituents, and for distinguishing isotropic from anisotropic crystals. Interior stresses in steel, which it has been claimed are also detectable by this method, could not be determined in more exact, recent investigations. SE + Ha (10)

Comment on Paper by M. U. Cohen: "The Elimination of Systematic Errors in Powder Photographs" (Bemerkung zur Arbeit von M.U. Cohen "The Elimination of Systematic Errors in Powder Photographs") A. IEVINS & M. STRAUMANIS. *Z. Krist.,* Vol. 95, Dec. 1936, pp. 451-454. In German. Continuing their controversy (see *Metals and Alloys,* Vol. 8, Feb. 1937, p. MA 99R/3, and Mar. 1937, p. MA 166R/7) the authors offer further evidence to prove that Cohen's method for determining the lattice constants according to the Debye-Scherrer Method "yields good results in only exceptional cases but furnishes unreliable values in the majority of cases unless the most probable lattice constant has already been derived by arithmetical means. EF (10)

Lattice Relationships Developed by the Peritectic Formation of Beta in the Copper-zinc System. ALDEN B. GRENINGER (Harvard Univ.) *Metals Tech.,* Vol. 4, Feb. 1937, T.P. 787, 12 pp. Original research. By seeding the crystallization of a 52-48 Cu-Zn alloy (β) with a Cu crystal or a crystal of α brass, specimens suitable for accurate X-ray study of orientation relationships developed by the peritectic reaction α + liq. $\rightarrow \beta$ were prepared. Specimens were examined by the back-reflection method and the orientations of adjacent α and β plotted stereographically. In spite of the high temperature of transformation, oriented lattices were developed. The β lattices are related to the α seed in such a way that the following 3 relationships are approximated:

$$\begin{array}{ll} \text{A} & \begin{cases} (110)\beta \;//\; (111)\alpha \\ (001)\beta \;//\; (110)\alpha \end{cases} \\ \text{B} & \begin{cases} (110)\beta \;//\; (111)\alpha \\ (111)\beta \;//\; (110)\alpha \end{cases} \\ \text{C} & \begin{cases} (100)\beta \;//\; (100)\alpha \\ (011)\beta \;//\; (010)\alpha \end{cases} \end{array}$$

Which of these is the more probable, and the displacements of atoms by each, are discussed, but it was impossible to define the most probable or mean lattice relationship. 12 references. See also *Metals and Alloys,* Vol. 7, Nov. 1936, p. MA 543L/10. JLG (10)

Titanium Carbide in Gray Cast Iron (Titankarbid in grauem Gusseisen) W. HOFMANN & A. SCHRADER. *Arch. Eisenhüttenw.,* Vol. 10, Aug. 1936, pp. 65-66. Original research. On adding Fe-Ti to gray Fe, hard, cubic, light-gray crystals appeared. These were extracted by dissolving the Fe in cold dilute HCl, and found to give the X-ray pattern of TiC. SE (10)

The Copper-zinc Diagram at Low Temperatures (Zur Frage nach dem Zustandsdiagramm von Cu-Zn bei tiefen Temperaturen) S. KONOBEJEWSKI & W. TARASSOWA. *Physik. Z. Sowjetunion,* Vol. 10, No. 3, 1936, pp. 427-428. In German. Original research. The fundamental work of Konobejewski and Tarassowa, who proved that the solubility of Sn in Cu does change materially with falling temperatures (*Metals and Alloys,* Vol. 6, Feb. 1935, p. 69L/7 and Oct. 1935, p. 409L/1) has been extended to the Cu-Zn diagram. Annealing of cold worked brass of 39% Zn at low temperatures disclosed that Cu dissolves only 33.35% Zn at 167° C. while 38.75% Zn is dissolved at 400° C. EF (10)

The Development of Ideas on the Transformations in Steels. G. B. WILLEY. *Metal Treatment,* Vol. 2, Winter 1936, pp. 181-183, 189. Review. 22 references. JCC (10)

Diffusion of Copper and Magnesium into Aluminum. R. M. BRICK & ARTHUR PHILLIPS (Yale Univ.) *Metals Tech.,* Vol. 4, Feb. 1937, T. P. 781, 17 pp. Original research. Rods of high-purity Al were fluxed and dipped into eutectics of Al-Cu and Al-Mg. Specimens so treated were heated to different temperatures for different times, and the diffusion resulting was determined by heat treating to precipitate excess Cu or Mg above solubility limit for different temperatures and the depth of diffusion then determined microscopically. Data enabled the preparation of depth-concentration curves. Diffusion coefficients were calculated and the change of the coefficients with temperature noted. Heat of diffusion was calculated from the Langmuir-Dushman equation and the slope of the $\ln D$——$1/T$ line. Values were approximately 31,500 cal. and 29,600 cal. for Cu and Mg respectively when calculated by the equation. Microscopic evidence of a possible anisotropy of diffusion of Cu into Al was found, but no crystallographic relationships were developed. Several diffusion-zone structures that showed straight-line markings and apparent lines of recrystallization were examined, with the conclusion that no true recrystallization had occurred. 5 references. JLG (10)

A Simplified Formula for Particle Size Determination by X-rays (Eine vereinfachte Formel zur röntgenographischen Teilchengrössenbestimmung) R. BRILL. *Z. Krist.,* Vol. 95, Dec. 1936, pp. 455-456. A new formula is introduced and applied to Fe nitride. Comparison with formula and determination of Natanson (*Metals and Alloys,* Vol. 6, Aug. 1935, p. 321L/5) on the same material is made. EF (10)

Metallography of Stainless Steels (Métallographie des Aciers Inoxidables) VAN DER BOSCH & VIALE. *Revue de Metallurgie,* Vol. 33, Nov. 1936, pp. 654-664; Dec. 1936, 721-726. Structures of a number of stainless steels are given. Etching reagents described in the literature were used. JDG (10)

Statistical Studies of Structure II, Measurement of Spatial Grain Size (Statistische Gefügeuntersuchungen II, Messung der räumlichen Kristallgrösse) E. SCHEIL & H. WURST (Kaiser-Wilhelm Inst. Metallforsch., Stuttgart) *Z. Metallkunde,* Vol. 28, Nov. 1936, pp. 340-343. Theoretical. Grain size measurements were made by means of a planimeter on a series of sections of Armco iron made by removing successively about 0.01 mm. from the surface. By means of the statistical methods developed in part I, the distribution curves for grain volumes are plotted, showing that the assumption of spherical grains leads to appreciable errors. Grain sizes may be measured as accurately with hexagonal nets as by the more laborious planimeter or paper-cutting methods.

GD (10)

The Importance of the Microscope for the Investigation of the Structures of Metals (Die Bedeutung des Mikroskopes für die Erforschung des Aufbaues der Metalle) WERNER KÖSTER (Kaiser-Wilhelm Inst. Metallforsch.) *Metallwirtschaft,* Vol. 16, Feb. 5, 1937, pp. 129-137. Descriptive discussion. The author strongly defends the use of the microscope for the construction of phase diagrams. The ability of the microscope to reveal structure peculiarities such as size and shape of constituents and their distribution is discussed. The Al-Mg-Zn system is used to illustrate the method of determining a ternary system with the microscope, emphasis being placed on the ability of the microscope to distinguish reactions, for example: Liq. $\rightarrow \alpha + \beta + \gamma$ or Liq. $+ \alpha \rightarrow \beta + \gamma$. Iron and its alloys are used to illustrate how polymorphic transformations may be followed with the microscope. The author concludes that the microscope is not absolutely necessary for the determination of phase diagrams, but when properly used is an extremely powerful tool. (The microscope combined with other methods is often preferred for the determination of complex systems: e.g. Fe-Mn System by F. M. Walters and coworkers. G.A.)

GA (10)

Specific Heat, Entropy, and Heat of Formation of Iron Carbide Fe_3C (Spezifische Wärme, Entropie und Bildungsarbeit des Eisenkarbids Fe_3C) C. SCHWARZ & H. ULICH. *Arch. Eisenhüttenw.,* Vol. 10, July 1936, pp. 11-12. Corrections to previous values given by Naeser (*Metals and Alloys,* Vol. 5, July 1934, p. MA 350 and Vol. 6, June 1935, p. MA 249L/5) are made. The following values are given for 25° C.:

Heat content of Fe_3C	4072 cal/mol
Entropy	23.9 cal/deg./mol

heat of formation $3Fe\alpha + C\beta_{graphite} \rightarrow Fe_3C + 2600$ cal/mol indicating Fe_3C to be slightly unstable at room temperature.

SE (10)

The Spatial Arrangement of Graphite in Cast Iron (Die raümliche Anordnung des Graphits im Gusseisen) P. SCHAFMEISTER. *Arch. Eisenhüttenw.,* Vol. 10, Nov. 1936, pp. 221-222; *Tech. Mitt. Krupp,* Vol. 5, Feb. 1937, pp. 17-19. Original research. In order to study the structure, amount, and formation of graphite, samples, in the form of thin plates, were exposed in a quartz tube to Cl_2 at 650° C. This destroyed all Fe and other metallic inclusions and left the graphite skeleton intact. The individual lamellae of the graphite dendrites contact and intersect each other without distinct orientation. Malleable Fe differs from gray Fe in that the C is distributed in the form of spheroids. The residue of gray Fe was determined as about 95% C, 3% SiO_2 with some Mn, and very small amounts of Fe and Al_2O_3. The graphite dendrites are shown in stereophotographs. 15 references.

SE + Ha (10)

Oxide Films on Iron. ROBERT F. MEHL & EDWARD L. MCCANDLESS (Carnegie Inst. Tech.) *Metals Tech.,* Vol. 4, Feb. 1937, T. P. 780, 23 pp. Original research. Orientation relationships bewteen α Fe and the phase "FeO" formed upon it by direct oxidation, and between Fe_2O_3 and FeO formed upon it by direct reduction were determined by X-ray diffraction. These relationships provide a simple atomic-crystallographic picture of the mechanism of oxidation. Orientation relationships between FeO and Fe_3O_4 formed from it by eutectoid decomposition are identical to those obtaining in oxidation layers. It is suggested that this may prove to be a general rule. No valid method now exists for determining the true thickness of films on Fe in the temper-color range. Rates of temper-film formation were determined at several temperatures on a large number of single crystals of H-purified Fe; the thickness being expressed in terms of colors equivalent to those displayed by a standard gage of Ba stearate monomolecular films of known thickness. A technique of surface preparation is described which gives reproducible temper colors on oxidation. No correlation of rates of oxidation with orientation was found. Rates are not parabolic on all crystals and show several irregularities. Micrographic evidence is given for the occurrence of severe stresses in these films. A mathematical treatment is given which shows that diffusion in cubic crystals should be isotropic. 37 references. See also *Metals and Alloys,* Vol. 7, Nov. 1936, p. MA 542L/3.

JLG (10)

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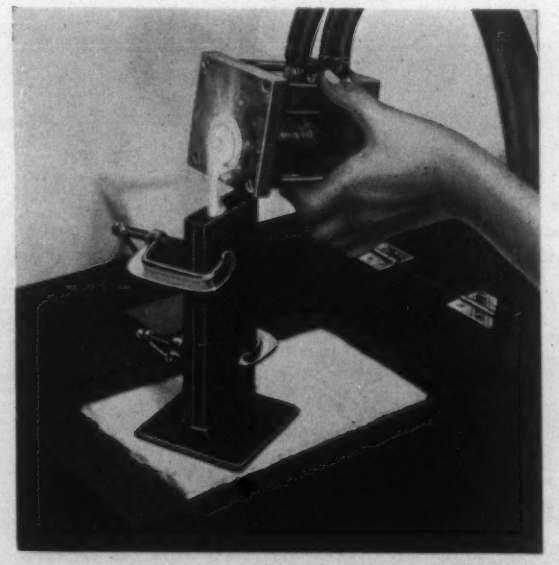

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11. PROPERTIES OF METALS AND ALLOYS

Principle of Steel Classification. I. N. GOLIKOV. *Metallurg,* Vol. 11, Nov. 1936, pp. 47-52. In Russian. A system of steel classification based on possible phase equilibria is proposed. All steels can be divided into 6 classes, from austenitic at all temperatures to ferritic at all temperatures. Proposed classification diagram given. (11)

Theory of Metallic Binding III (Zur Theorie der Metallischen Binding III) PAUL GOMBÁS. *Z. Physik.,* Vol. 104, Dec. 15, 1936, pp.81-92. Original research at the Institut für Theoretische Physik der Universität in Budapest. Mathematical exposition based on lattice constants and energy of sublimation of Ca. FHC (11)

Remarks on Scratch Hardness (Bemerkungen über die Ritzhärte) G. TAMMAN & R. TAMPKE (Göttingen) *Z. Metallkunde,* Vol. 28, Nov. 1936, pp. 336-337. Survey plus original discussion. Experiments on a variety of metals are cited to show that below the recovery temperature scratch hardness (measured by width of scratch) is independent of temperature and amount of cold work, because the maximum hardness of the metal is attained while making the test; while above this temperature scratch hardness decreases with increasing temperature because recovery occurs during the test. GD (11)

Variations with Time in the Resistance of Thin Layers of Metals Vaporized in High Vacuum (Ueber Zeitliche Widerstandsänderungen Dünner, im Hochvakuum Anfgedampfter Metallschichten) VLADIMIR VAND. *Z. Physik,* Vol. 104, Dec. 5, 1936, pp. 48-67. Original research at the Spektroskopisches Institut der Karls-Universitat in Prague. Resistance measurements on thin layers of Au and Ag vaporized in vacuum show a variation with time due, the author claims, to a distortion of the space lattice. Mathematical exposition shows that this variation is a hyperbolic function of the time. FHC (11)

Relation of Temperature to Magnetostriction of Ni (Ueber die Temperaturabhängigkeit der Magnetostriktion von Nickel) W. DÖRING (Technische Hochschule, Berlin) *Z. Physik.,* Vol. 103, Dec. 5, 1936, pp. 560-582. Original research with mathematical discussion. The saturation point of magnetostriction is measured and curves are drawn to show the relation to the magnetization in polycrystalline nickel at different temperatures up to the Curie point. FHC (11)

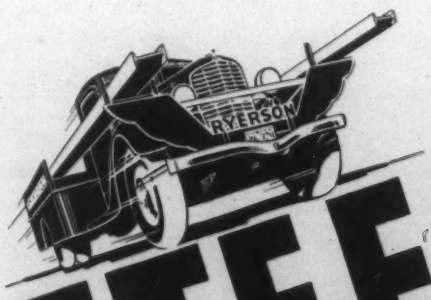
11a. Non-Ferrous

A. J. PHILLIPS, SECTION EDITOR

The Effect of the Addition of Lead on the Endurance Limit of a Certain Tin-base Bearing alloy. JOHN N. KENYON. *Proc. Am. Soc. Testing Materials,* Vol. 36, Pt. II, 1936, pp. 194-197; discussion, pp. 198-200. See *Metals and Alloys,* Vol. 7, Aug. 1936, p. MA 412R/8. VVK (11a)

Hexagonal Structure of Magnesium (Die hexagonale Struktur des Magnesiums) G. BOEHME. *Z. Ver. deut. Ing.,* Vol. 87, Jan. 30, 1937, p. 126. The specific properties of Mg in working and deforming are explained on the basis of its hexagonal structure. Ha (11a)

Influence of Additions on Workability, Electric Conductivity and Mechanical Properties of Aluminum. M. P. SLAVINSKI, I. N. KALMIKOV & A. E. VOL. *Metallurg,* Vol. 11, Nov. 1936, pp. 16-24. In Russian. Original research, using metals of commercial purity. Alloys of Al with Sn, Cu, Zn, Pb, Mg, Si and Fe were investigated. Improvement of mechanical properties of Al intended for electric conductor purposes can be achieved by adding to it 1% max. Cu, 1% max. Mg, 2% max. Si and 1% max. Fe. Mg addition seems to be the best. (11a)



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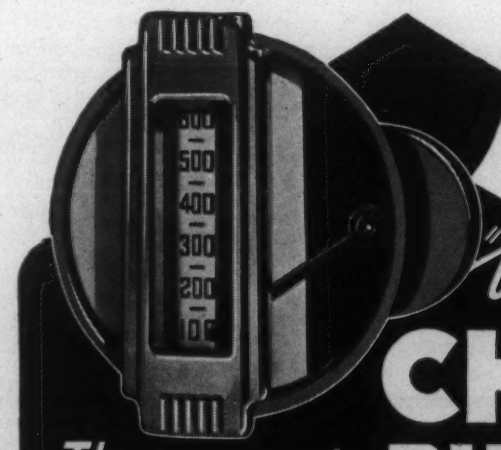

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Influence of Method of Deformation and Thermal Treatment on the Endurance Limit of Age-hardening Aluminum Alloys (Einfluss der Verformungsart und der thermischen Vergütung auf die Ermüdungsfestigkeit von vergüteten Aluminium-Legierungen) H. BOHNER. *Metallwirtschaft,* Vol. 15, Aug. 28, 1936, pp. 813-814. An alloy analyzing 5.65% Cu, 0.67% Mn, 0.14% Si, 0.23% Fe, balance Al, was made into 220 mm. rods at 500° and (a) forged into 22 mm. square bars, (b) rolled to 90 mm. square bars, annealed at 500°, and rolled to 22 mm. square bars, and (c) the 22 mm. bars of (b) were cold drawn to 20 mm. round bars. These were then quenched from 520° and annealed at 120° for 24 hours, after which only (a) has a preferred orientation. The endurance limits of (b) and (c) were about the same and appreciably higher than those of (a). A series of experiments designed to show the effects of thermal treatment on the endurance limit showed: (1) Aged material has a higher endurance limit than quenched. (2) The endurance limit is increased by time of aging and temperature of aging. (3) The quenching temperature has little effect. (4) There is little connection between the static and dynamic properties of the same alloy. (5) The chemical composition and structure of light alloys is of more importance than their mechanical properties in determining the endurance limit. **The Repeated Impact Resistance of Age-hardened Aluminum Alloys (Die Dauerschlagfestigkeit vergüteter Aluminium Legierungen)** *Ibid.* Oct. 16, 1936, pp. 983-984. Repeated impact tests on age hardened Al alloys and ingot Fe showed that the values for rolled material are better than for forged material and that these can be correlated with the hardness and chemical composition. The light metals are superior to Fe when values are adjusted to the same weight per unit length of the test specimen.

GD (11a)

Measurement of the True Specific Heat of Silver, Nickel, β-Brass, Crystalline Quartz and Quartz Glass between +50 and 700° C. by an Improved Method (Messung der wahren spezifischen Wärme von Silber, Nickel, β-Messing, Quarzkristall und Quarzglas zwischen +50° und 700° C. nach einer verfeinerten Methode) HELMUT MOSER. *Physik. Z.,* Vol. 37, Nov. 1, 1936, pp. 737-752. The new testing method is based on the use of a Ag-calorimeter and Argon atmosphere at reduced pressure. The determinations are almost adiabatic, and accurate within ±0.5%. The results are shown in c_p/temperature plots and are tabulated. Contrary to findings of Jaeger, Rosenbohm & Botlema, the same c_p values were found for ordinary and "stabilized" Ag. The anomalies of specific heat near the transformation points of Ni, β-brass and SiO_2 were found to occur over a much more extended temperature range than previous, less accurate methods had indicated A notable increase of c_p values starts 300° below the transformation point characterized by a very pronounced peak value. Taking X-ray results into consideration, the phenomena during and preceding the $\alpha \rightarrow \beta$ transformation in SiO_2 are interpreted.

EF (11a)

Thermal Expansion Coefficients of Magnesium and Its Alloys. KIYOSI TAKAHASI & RIMPEI KIKUTI. *Kinzoku no Kenkyu,* Vol. 13, Oct. 1936, pp. 401-414. In Japanese. The linear thermal expansion coefficients of pure Mg, various binary alloys of Mg and Ag, Al, Cd, Cu, Ni, Sn, Zn and a large variety of commercial alloys of Mg, were determined in the temperature range 0° to 500° C. by the instrument devised by Honda. The changes in coefficient with additions were less than those indicated by additive law. Some anomalies in temperature coefficient curves were explained by the aid of the appropriate equilibrium diagram.

KT (11a)

Influence of Aluminum on the Properties of Copper-beryllium Alloys. YU. A. AMSTERDAMSKI. *Metallurg,* Vol. 11, Nov. 1936, pp. 90-102. In Russian. Alloys containing 0.02 to 5% Al and 2% Be and alloys containing 5% Al and 1-2% Be were studied metallographically and by hardness determinations. Al addition to 2% Be alloy leads to continuous increase of β phase so that at 850° C. and 5% Al only β is present. In alloys with more than 2% Al higher quenching temperature increases the amount of β phase, in those containing less than 2% it decreases it. The region of ternary (Cu-Be-Al) α crystals becomes narrower with increasing Al. Decreasing temperature narrows α region sharply in Cu-Be alloys, and less when Al is present, which leads to lesser aging of ternary alloys. Hardness continuously increases with Al addition. Quenching from 850° C. softens Cu-Be alloys to 80-90 Brinell but hardens Cu-Be-Al to 250-270. Tensile strength of alloys quenched from 850° C. increases 8,500-10,000 lbs./in.² for each per cent of Al up to 4%. Elongation drops from 55-58% with 0.04% Al to 40% at 2% Al, 15% at 3% Al and 7% at 4% Al. Tensile strength increases similarly, 67,000, 81,000, 85,000 and 100,000 lbs./in.² respectively. Alloy with 5% Al and 2% Be quenched from 800° C. has 2-3% elongation and 78,000-85,000 lbs./in.² tensile strength. Optimum drawing temperature for Cu-Be alloys is 290-300° C. and must be raised proportionally to Al content.

(11a)

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Mechanical Properties of Single and Muiltiple Aluminium Crystals. G. WELTER & T. MOJMIR. *Metallurgia,* Vol. 15, Dec. 1936, pages 49-53. Single-crystal specimens were made by recrystallizing Al of 99.8 and 99.5% purity. Specimens were tested in tension to determine influence of orientation on Young's modulus, limit of elasticity, strength and elongation. Elastic limit varies from 1,065 to 2,275 lbs./in.² depending on orientation, Young's modulus from 7,460,000 to 10,160,000 lbs./in.², strength from 8,000 to 11,500 lbs./in.², and elongation from 53.2 to 97%.

JLG (11a)

Tombasil, A Copper Alloy of High Fluidity (Tombasil) *Werkstoffe und Korrosion,* Supplement to *Chemische Apparatur,* Vol. 23, Nov. 1936, page 83. Cu content over 80%, tensile strength 65,000-70,000 lbs./in.², elongation 12-15%, Brinell hardness 120-150, melting point 920-930° C., shrinkage 1.6-1.8%. Corrosion resistance against solutions containing 10% HCl, H_2SO_4, CH_3COOH, KOH and other chemicals is equal to that of Cu.

HR (11a)

Study of Copper-Beryllium Alloys. M. I. ZAKHAROVA. *Metallurg,* Vol. 11, July 1936, pages 101-105. In Russian. Influence of cold deformation on the speed of decomposition of Cu-Be solid solution was studied by cold rolling sheets 20 to 80% and by filing samples. Degree of decomposition was determined by hardness measurements and X-ray study. Speed of decomposition of Cu-Be solid solution is directly proportional to Be concentration (1.4 to 2.1% Be) and to temperature, and is accelerated in direct proportion to amount of cold deformation. Influence of the latter is more pronounced when applied after the latent period than when the metal is rolled after quenching. (11a)

An Investigation to Develop Hard Alloys of Silver for Lining Ring Grooves of Light Alloy Pistons. CLAUS GUENTER GOETZEL (Inst. Angew. Metallkunde of Tech. Hochschule, Charlottenburg) *Metals Tech.,* Vol. 4, Feb. 1937, T. P. 794, 5 pp. Original research. Alloys were studied in an attempt to find a Ag-base alloy to replace high-expansion austenitic Fe-Ni alloys. M. p. should be over 850° C. and Brinell over 60. Liquidus and solidus and Brinell hardness of following Ag-rich alloys were determined, but none met qualifications: Ag-Mg, Ag-Mn, Ag-Mn-Mg, Ag-Mn-Al, Ag-Mn-Zn, Ag-Mn-Si, Ag-Mn-Si-Cr, Ag-Mn-Si-Fe, Ag-Sb-Zn, and Ag-Sb-Zn. Ag-Mn-Si and Ag-Sb-Cd alloys had properties approaching those desired.

JLG (11a)

Alloys of Aluminum with Copper and Tin. M. I. ZAMOTORIN (Ind. Inst., Leningrad) *Metallurg,* Vol. 11, Nov. 1936, pp. 103-108. In Russian. Original research. Alloys were prepared in 300 g. batches from Al containing 0.28% Fe and 0.25% Si. One half was used for determination of critical points, the other annealed at 200° C. for 60 days. Specimens were studied metallographically and hardness and tensile properties were determined. Phase diagram at room temperature for alloys containing 10% each of Cu and Sn is given. Sn solubility increases with Cu content, with 10% Cu about 5% Sn is held in solid solution. With increasing Cu content plastic properties of the ternary alloy decrease. Elongation and reduction of area are lowered by Sn in soluble amounts; larger quantities have no effect. Machining properties are improved both by Cu and Sn. Sn does not increase corrosion resistance when present in solid solutions, but in larger amounts it decreases it, as does Cu. (11a)

Fatigue Properties of Five Cold-rolled Copper Alloys. WILLIAM B. PRICE & RALPH W. BAILEY (Scovill Mfg. Co.) *Metals Tech.,* Vol. 4, Feb. 1937, T. P. 786, 12 pp. Original research. Three P bronzes, a 3% Si Cu-base alloy, and a Cu-Ni-Sn alloy (Adnic) were tested. All were in the form of 0.025 in. strip rolled 6 numbers hard. Tests were made to 50 million cycles on a Townsend-Greenall machine. Previous to testing surfaces were polished with 00 emery cloth. Tests indicated that P in the amount of 0.106% in the 5% Sn bronze was detrimental to the fatigue properties at stresses above the endurance limit. The P bronzes had a definitely higher fatigue limit than the other materials tested. Specimens tested without polishing with emery gave erratic results. Fatigue limits for the P bronzes were from 33,600 to 36,000 lb./in.^{2}, for the Si bronze 29,000 lb./in.^{2}, and for the Cu-Ni-Sn alloy 27,000 lb./in.^{2} 6 references. JLG (11a)

Hardenable Copper-nickel-tin Bronzes VII, Temperature Stability of the Hardness (Ueber aushärtbare Bronzen auf Kupfer-Nickel-Zinn-Basis VII, Temperaturbeständigkeit der Aushartung) E. FETZ. *Z. Metallkunde,* Vol. 28, Nov. 1936, pp. 350-353. Review plus original research. The hardness of a variety of Ni-Sn bronzes, which had been water quenched, air cooled, and aged to maximum hardness, is determined for annealing times up to 5000 hrs. at 250°, 2000 hrs. at 300°, 350°, and 400°, 1000 hrs. at 450°, and 100 hrs. at 500°, 560°, and 600° C. The stability of these alloys is greatest when the α solid solution has decomposed completely; tensile tests show that mechanical properties are the same for aged and overaged alloys of the same hardness. The long time heating tests show that softening is independent of the pretreatments indicated above. The most stable compositions are those with the highest Ni content, consequently the highest melting point. Under given conditions the hardness usually reaches a steady value. GD (11a)

Anisotropy of Changes in Resistance Produced in Cubic Metal Crystals by a Magnetic Field at Low Temperatures (Anistropie der magnetischen Widerstandsänderung kubischer Metallkristalle in tiefen Temperaturen) H. J. SEEMANN (Physikalisch-Technischen Reichsanstalt) *Z. Metallkunde,* Vol. 28, Nov. 1936, pp. 358-359. Description of current research. Single crystal rods of Au were placed normal to a magnetic field of 21,700 Gauss, and the resistance along the axis of the rod measured as the rod was rotated about this direction at 20.38° K. The ratio, $\frac{R_H}{R}$, of the resistance in the field to the normal resistance is plotted for a rod with a [100] direction parallel to the axis of the rod, showing eight symmetrically spaced maxima; with a [111] direction parallel to the rod axis 12 maxima are distributed along an ellipse. The effect is greater at 14° K. and vanishes when the temperature is increased to 78° K. Al showed a similar effect but Cu and Ag showed none. See also *Metals and Alloys,* Vol. 7, Jan. 1936, p. MA 28L/4. GD (11a)

A Study of the Heat of the Magnetic Transformation in Nickel (Untersuchungen über die Wärmetönung bei der magnetischen Umwandlung des Nickels) H. v. STEINWEHR & A. SCHULZE. *Z. Metallkunde,* Vol. 28, Nov. 1936, pp. 347-349. **Study of Thermal Changes During Metallic Transformations. IV. Nickel (Untersuchungen über die Wärmetönung bei metallischen Umwandlungen. IV. Nickel)** IDEM. *Physik. Z.,* Vol. 37, Nov. 1, 1936, pp. 753-757. Original research. The method previously described (see *Metals and Alloys,* Vol. 6, Jan. 1935, p. Ma 26L/5), was used for a redetermination of the heat developed in Ni during its magnetic transformation. Material containing a total of 0.90% impurities gave a value of 0.65 + 0.06 cal./g. The transformation occurred between 330° and 360° C. An additional small thermal effect was observed at 220° C., but no explanation for it is offered; the same phenomenon was also observed with carbonyl Ni at 210° C. For previous work, see also *Metals and Alloys,* Vol. 6, Jan. 1935, p. MA 26L/5, and Dec. 1935, pp. MA 504R/2 and 503R/9. GD + EF (11a)

11b. Ferrous

V. V. KENDALL, SECTION EDITOR

Monel- and Nickel-plated Steel Sheets; Fabrication and Economic Importance as Raw Material for Chemical Apparatus (Grundlagen der monel- und nickel-plattierten Flussstahlbleche, Bearbeitung und wirtschaftliche Bedeutung für die Rohstoffgestaltung im chemischen Apparatebau) RUDOLF MÜLLER. *Chem. App.,* Vol. 24, Jan. 25, 1937, pp. 19-22. Comprehensive survey. Production, properties and fields of application of steel sheets mechanically plated with Ni or Monel metal are discussed. Mechanical properties of several combinations are as follows:

Plating	Tens. Strength lbs./in.^{2}	Elong. %
None	52,000	20-25
10% Cu	50,000-58,000	23-30
10% Ni	55,000-62,000	27-30
10% Monel	about 57,000	about 28
10% Austenitic Ni-Cr steel	about 58,000	about 27

HR (11b)

The Practical Importance of the Damping Capacity of Metals, Especially Steels. O. FÖPPL. *Iron & Steel Institute,* Sept. 1936, Advance Copy No. 2, 31 pages; *Engineer,* Vol. 162, Oct. 9, 1936, page 388. Includes discussion. Under cyclic stress well within the fatigue limit many steels exhibit appreciable plastic strain. The "damping capacity" depends on the ratio of the plastic to the elastic strain, and is best defined by the non-dimensional ψ, obtained by dividing the area of the hysteresis loop by the strain energy stored in the extreme portion of the cycle. Damping does not foretell impending fatigue failure, nor does it tend to disappear under prolonged cyclic stressing. On the contrary, it is capable of dissipating an unlimited amount of energy in heat without damage to the material. Ultimate damping (the steady value obtained after some millions of cycles) is often higher than initial damping. Unlike most other mechanical properties, ψ is not affected by weak spots and is independent of the form of the specimen. The value of ψ is of great importance because a high value confers notch-toughness in fatigue and because it controls the amplitude of undesired and often dangerous vibrations at critical speeds. Five methods for determining ψ are described. The method of free torsional vibrations receives preferential treatment, and the Föppl-Pertz apparatus is described in detail. Damping curves for different Fe alloys are given. Damping in torsion is compared with damping in flexure. Limits within which damping is independent of frequency are discussed. The need for a ductile steel that will give high damping at low stresses is pointed out. An appendix containing notes on the terminology of damping gives definitions of German words. 27 references. JLG + VSP (11b)

High-speed Tool Steel. JAMES P. GILL. *Metal Progress,* Vol. 30, Nov. 1936, pp. 42-48. Refers to the conventional 18-4-1 W-Cr-V high speed steel with C 0.70%, Si 0.20% and Mn 0.25%. Distribution of carbides or excess constituent (Fe_3W_3C and Fe_2W) is a function of ingotism and amount and character of working to which the metal has been subjected. Angular particles give lower hardness than spheroidal particles. Increased grain size results in decreased strength and plasticity. Variation in size, shape and agglomeration of the segregate do not affect thermal conductivity. Form of carbide segregate affects rate of diffusion and hardenability. Large grained steel shows greater hot hardness. Susceptibility to grain growth is not a characteristic of melting. Considerable time is required to remove hardening stresses and when fully removed they have slight effect on rehardening. Grain size is affected by furnace atmosphere during hardening only as composition of gases affect rate of heating and temperature of specimen. See also *Metals and Alloys,* Vol. 8, Mar. 1937, p. MA 178L/8. WLC (11b)

Wear Resistance of Nitrided Measuring Gages. I. F. AFONSKI & M. B. BATANOV. *Metallurg,* Vol. 11, Oct. 1936, pp. 84-93. In Russian. Nitrided gages wear better than carburized gages. (11b)

Comparative Investigations of Heat-resisting Materials at Elevated Temperatures (Vergleichende Untersuchungen von warmfesten Werkstoffen bei höheren temperaturen) F. KÖRBER & A. POMP. *Mitt. Kaiser-Wilhelm-Inst. Eisenforsch., Düsseldorf,* Vol. 18, No. 18, 1936, pp. 247-251. Cr-Si; Cr-Ni-W; Cr-Co; Cr-Mo-Co with some V; Cr-Ni steels of low C and W, Mo and Ti; Cr-Mn-V of high Si; and a high Ni steel with high additions of Cr, Mo and Mn were investigated as to their mechanical properties at temperatures between 600° and 900° C. Micrographic structure, deformability, tensile strength, hardness and endurance limit were determined. Cr-Si-V steel has the highest tensile strength 88,000 lbs./in.^{2} at 600° C. Cr-Ni steel with low C shows the best creep resistance. Ha (11b)

Final Report on Effect of Sulfur in Steel. Report of Joint Committee on Investigation of the Effect of Phosphorus and Sulfur in Steel. H. S. RAWDON, CHAIRMAN. *Proc. Am. Soc. Testing Materials,* Vol. 36, Pt. I, 1936, pp. 88-91. Survey. The work of the committee since 1922 is summarized and general conclusions drawn. On the basis of the test data, the committee announced its general conclusion (1926) that S in rivet steel up to and including 0.06% is not detrimental. For material in each of the three conditions, natural, annealed and quenched, an increase in S from 0.063 to 0.18% was accompanied by a decrease in ductility (elongation and reduction of area) perpendicular to direction of rolling and also in the impact resistance for material tested both parallel and perpendicular to the direction of rolling. However, for the same range in S content for material in the natural, annealed and quenched conditions no systematic relation with S was found for tensile strength, proportional limit and yield point for material tested both parallel and perpendicular to direction of rolling; percentages of elongation and reduction of area for material tested parallel to direction of rolling; shearing strength; hardness; torsional properties; endurance limit; cold bend tests of bars; cold bending, hot flattening, and hot and cold upsetting tests of rivets. Cooncerning structural steel (plate), the committee concluded (1927) that S up to 0.077%, the maximum used in the tests, is not detrimental. No systematic relation was noted between S content and the tensile, shear and bend properties of the plate in the natural, normalized, annealed and quenched conditions. All the values for impact resistance showed such wide variation in individual results that no conclusions regarding any deleterious effect of S with respect to this property could be drawn. No systematic relation between increasing S contents and the physical properties of forging steel was found and no permissible maximum content was expressed. A S content of 0.07% for wrought plain C steels of .55% C max. and 0.70% Mn max. when used under conditions in which the transverse properties are not of controlling importance is permitted. For rivet stock, 0.06% S still stands because of possible S pickup in fabrication. See *Metals and Alloys,* Vol. 6, June, 1935, p. MA 248L/5. VVK (11b)

Comparison of Soft Bessemer, Basic Bessemer and Open-hearth Steels. P. P. CHICHKANOV & V. YA. CHUPRAKOV. *Metallurg,* Vol. 11, Oct. 1936, pp. 78-83. In Russian. Heavy machinery built in a Urals plant and stored at —20° to +25° C. developed an epidemic of cracking. It was noted that only Bessemer steel, acid or basic, was susceptible to failure. An investigation of these steels as well as of a killed open-hearth steel showed that down to 25° C. the impact properties of the three steels were about the same, but under it the impact strength of Bessemer steel was about ½ Kg-m./cm.² while the impact strength of open-hearth metal remained about 4. (11b)

Variation in Tensile Strength and Brinell Hardness of Cast Iron with the Wall Thickness (Aenderung von Zugfestigkeit und Brinellhärte bei Gusseisen mit der Wandstärke) H. JUNGBLUTH. *Arch. Eisenhüttenw.,* Vol. 10, Nov. 1936, pp. 211-216. Casts of cupola Fe showed that the sensitivity to wall thickness was 2½ to 3 times as great in separately poured test pieces as in a box casting of the same wall thickness. The sensitivity to wall thickness decreased in stronger Fe. SE (11b)

A Thermal Expansion Phenomenon in Platinum-iron Alloys (Über eine Ausdehnungsanomalie der Platin-Eisenlegierungen) A. KUSSMANN. *Physik. Z.,* Vol. 38, Jan. 15, 1937, pp. 41-42. Original research. The Invar phenomenon in Fe-Ni with 35% Ni has been known for quite some time. The general structural analogy between the Fe-Ni and Fe-Pt systems suggested a search for this anomaly in Fe-Pt alloys, which revealed that between 50 and 60% Pt small positive and even considerable negative values of the thermal expansion coefficients do exist. EF (11b)

Cast Crankshafts (Gegossene Kurbenwellen) F. ROLL. *Z. Ver. deut. Ing.,* Vol. 80, Nov. 14, 1936, pp. 1365-1368. Descriptive review. Superior damping capacity of cast ferrous materials is cited as important factor in this application. Structure, composition and shape must be considered. Ha (11b)

Heat Conductivity of Chromium Steels at Elevated Temperatures (Wärmeleitfähigkeit von chromhaltigen Stählen bei hohen Temperaturen) E. MAURER. *Arch. Eisenhüttenw.,* Vol. 10, Oct. 1936, pp. 145-154. Original research. Previous determinations of the heat conductivity of various Cr stainless steels are reviewed and new data given for the heat conductivity of 10% Cr, 10-20% Cr, Cr-Ni steels with up to 10-20% Ni and high Ni, Ni-Cr alloys at temperatures up to 1100° C. SE (11b)

High Manganese Steel. L. SANDERSON. *Indian & Eastern Eng.,* Vol. 78, Apr. 1936, pp. 298-299. Practical notes on its special characteristics and applications. APS (11b)

Magnetic Anisotropy of Iron in Relation to Temperature (Magnetische Anisotropie des Eisens in Abhängigkeit von der Temperatur) E. F. TITOW. *Physik. Z. Sowjetunion,* Vol. 10, No. 3, 1936, pp. 337-347. In German. The phenomenon of anisotropy in crystals is independent of temperature; only the absolute value of the constant of anisotropy changes. The experimental results obtained on Fe single and polycrystals are in good agreement with theoretical values in the temperature range of 0°-450° C. EF (11b)

Proportional Limit of Cast Iron (Knickfestigkeit von Gusseisen) G. BIERETT. *Arch. Eisenhüttenw.,* Vol. 10, Oct. 1936, pp. 165-169. A method of determining the proportional limit of cast Fe in compression by stressing a tube specimen eccentrically and also axially is described. Cast Fe showed higher proportional limits in compression than structural steel. SE (11b)

First Report of the Alloy Steels Research Committee. *Iron & Steel Institute,* Special Report No. 14, Sept. 1936, 262 pages. Section I is an introduction. Section II, by W. H. HATFIELD, discusses ferrous alloy systems and calls attention to the large number of systems possible by combinations of Fe with elements used in steels. Section III, by L. ROTHERHAM, reviews a series of 3 lectures by W. L. Bragg on atomic arrangements in alloys. Section IV, by J. H. G. MONYPENNY, reviews constitutional data on alloys of Fe, Cr, and C. Section V, by C. H. DESCH, describes constitution of Fe-Ni alloys and contains a bibliography of 191 references prepared by W. T. GRIFFITHS. Section VI, by C. H. DESCH, reviews information of Fe-S alloys. Section VII, by J. H. ANDREW & C. G. NICHOLSON, reports thermal and microscopic data obtained for the Fe-Co system. Section VIII, by W. R. MADDOCKS & G. E. CLAUSSEN, deals with Fe-Cu-C-Co alloys. No liquid miscibility gap was found in the Fe-Cu system. Other results on the study of this system are in agreement with previous work. Data were obtained for construction of the Fe-Cu-C diagram above 1080° C. The ends of the monotectic 4-phase horizontal (1150° C.) are at 3% Fe, 0.01% C, and 2-2½% Cu, 4.2% C. The temperature of the peritectic plane is 1094° C. and the maximum temperature of the 2-liquid boundary curve is 1430° C. The focal point of the 2-conjugate liquid curve is slightly less than 50% Cu, 50% Fe. This Fe-Co-Cu system was studied and no region of liquid immiscibility found. The Cu-rich peritectic liquid holds slightly more than 1.5% each of Co and Fe, and thus changes in composition continuously from slightly less than 3% Fe on the Fe-Cu edge to slightly more than 4% Co on the Co-Cu edge. Section IX deals with thermal treatment. Part B, by G. STANFIELD, discusses the influence of temperature distribution in the heating of steel on stresses. Part C, by T. F. RUSSELL, is a mathematical consideration of temperature distribution on heating and cooling. Data for calculating temperature distribution of several simple shapes on heating and cooling are given. Section X, by G. WESLEY AUSTIN, deals with burnt steels. Effect of burning on mechanical properties of test pieces, on strength of a closed vessel, and on microstructure are given. Section XI, by A. PREECE, G. T. RICHARDSON & J. W. COBB, gives data on scaling of steels in S-free and S-containing atmospheres. Section XII, by J. H. ANDREW & D. SWARUP, reports results on study of influence of P on Fe and Fe-C alloys. Section XIII reviews 3 papers presented at Chemical Engineering Congress of the World Power Conference, 1936. *Alloys of Iron—Copper—Carbon—Cobalt.* W. R. MADDOCKS & G. E. CLAUSSEN. *Iron & Coal Trades Rev.,* Vol. 133, Nov. 27, 1936, pp. 941. JLG+Ha (11b)

Present Trend in Alloy Constructional Steels. J. A. JONES. *Iron & Coal Trades Review,* Vol. 133, Nov. 13, 1936, pages 854-855. *Iron & Steel Ind.,* Vol. 10, Dec. 1936, pages 194-201; Jan. 1937, pages 236-238. The development of the various Cr and Ni steels and their properties are reviewed. The influence of the various alloy elements in reducing the effect of mass during quenching can be judged by the relative reduction of the critical cooling velocity of the steel; Cr and Mn are much more effective for this purpose than Ni. Action of Cr, Mn and Mo are described and the properties of steels containing 2 alloy elements discussed. Substitution of Ni in Ni steels by Mn results in reduction of price with improvement in mechanical properties. The susceptibility of Ni-Mn and Ni-Cr steels to temper-brittleness can be overcome by addition of Mo. Mo-containing steels are now widely used in steam service at elevated temperatures where high creep-resistance together with complete immunity from embrittlement by continued use at the high temperatures is required. Ha + CEJ (11b)

Standard Structure for Iron Castings. S. M. SKORODZIEVSKI. *Liteinoe Delo,* Vol. 7, No. 8-9, 1936, pages 10-13. Irons of the same composition were classified into four groups according to the size of graphitic inclusions and openness of pearlite. They were compared as to wearing properties when cast into tractor packing rings. The wear increased with the size of graphite inclusions and the amount of ferrite observed. A method for determining the area of graphite particles is given. (11b)

12. EFFECT OF TEMPERATURE ON METALS AND ALLOYS

H. C. CROSS, SECTION EDITOR

The abstracts in this section are prepared in co-operation with the Joint High Temperature Committee of the A.S.M.E. and the A.S.T.M. The purpose of this co-operation is to make readily available complete references to the literature of this subject. The Committee does not ncessarily subscribe to the statements of either the author or the abstractor.

Mechanical Properties of Special Steels and Non-ferrous Metals at Low Temperatures. B. SMIRNOV & V. CHERNIAK. *Metallurg,* Vol. 11, Aug. 1936, pp. 88-103. In Russian. Physical properties were determined at room temperature, at —40°, —80° and —183° C. Cu-bearing steels (0.09-0.3% C, 0.07-0.38% P, 0.16-1.23% Cu), Ni-Cu and Cr-Cu steels have no better impact values at low temperatures than common C steels. Influence of P content was studied using steels with the same Cu and varying P content and found to be negligible. Steel with 5% Ni was the best in the pearlitic class, but satisfactory results could be obtained with it only after heat treatment. Alloys with 2.25% Ni-1.0% Cr and Cromansil (0.75% Si, 1.25% Mn, 0.50% Cr) had practically the same tensile properties as 5% Ni steel but a lower impact strength which decreases slowly and uniformly over the temperature range. Silchrome (0.37% C, 3.2% Si, 10.32% Cr) is quite brittle at low temperatures, while 18% Cr-8% Ni steel has practically the same impact strength at —183° C. as at room temperature. Yellow brass and duralumin increase in strength at low temperatures. Impact strength remains practically constant for brasses and increases slightly for duralumin at —183° C. (12)

3 **Effect of Molecular Nitrogen on Molybdenum at High Temperatures.** PAUL TURY & STEPHEN KRAUSZ. *Nature,* Vol. 138, Aug. 22, 1936, page 331. Mo wires when annealed in N_2 show a higher yield point than when annealed in H_2, A or vacuum. The previous condition of the wire effects the speed of reaction to nitrogen; cold work subsequent to N_2-annealing removes the effect, as does subsequent annealing in vacuum or in A. The N_2 "sorbed" is less than 0.007%. CSB (12)

4 **Method of Thermal Autostabilization and Long Time High Temperature Tests (La Methode d'Autostabilisation Thermique et les Éssais à Chaud de Longue Durée)** GEORGES RANQUE & PIERRE HENRY. *Rev. Mét.*, Vol. 33, Oct. 1936, pages 598-601. After 5 years of experimentation with Rohn type of automatically controlled device it was found that creep can be expressed by a formula that permits extrapolation of values after comparatively short time tests, and that there is no creep limit. Below 450° C. the amount of previous cold deformation has a pronounced effect on creep characteristics; above this temperature the influence is negligible. JDG (12)

5

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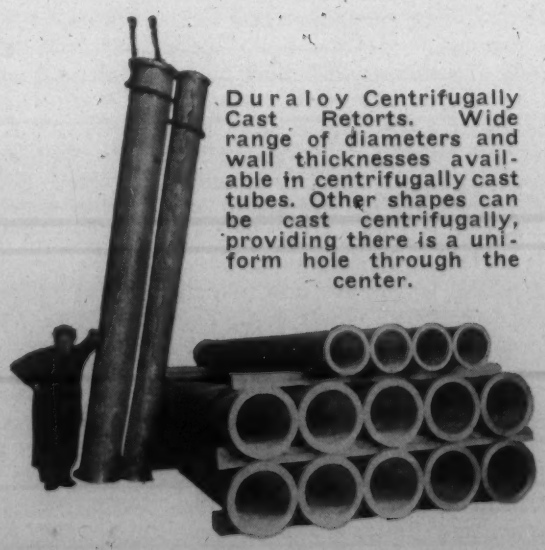

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13. CORROSION AND WEAR

V. V. KENDALL, SECTION EDITOR

The Protection of Ship's Hulls Against Marine Corrosion. WILLIAM E. LEWIS. *Trans. N. E. Coast Inst. Eng. Shipbuilders,* Vol. 52, 1935-36, pp. 126-142; discussion pp. D23-D48. The electrochemical nature of corrosion of hulls and means of combating such corrosion by introducing Zn into the system are reviewed. Tests by author on pre-war and post-war polished specimens of mild steels indicate that claims for superiority of the metal of pre-war steels in sea-water corrosion are unfounded. A Cu steel under same test indicated initial superiority but at end of 1 yr. became slightly less resistant than the other mild steels. Review is made of Institution of Civil Engineers' sea-water corrosion tests at Plymouth, Colombo, Halifax and Auckland with the conclusion "that the conditions under which mild steel is exposed to corrosive influence have a greater effect upon its corrodibility than minor differences in either its chemical or metallurgical constitution." One exception is noted for rivets made of rimmed steel which pit very rapidly in sea-water service. The use of Cu alone or with low Cr in mild steels is considered to be desirable direction of development for marine steels. For economic reasons it is hopeless to expect perfect resistance for marine construction and greater reliance should be placed on insulating the structure from the corroding agent by means of paint, etc. The rôle of mill scale in corrosion of steel plate is discussed from tests made on pre-war and post-war steels. The pre-war steels produced on reversing plate mill have reddish scale, outer layer of Fe_2O_3 thicker than that of post-war steel produced on modern high speed mill at higher temperature than formerly. The scale of latter is blue-black and consists of thin Fe_2O_3 outer layer, thicker Fe_3O_4 and very thick FeO layer while the pre-war steel has extremely thin FeO layer. The opinion is that the FeO immediately adjacent to the metal is oxidized to hydrated Fe_2O_3 and increases in volume which in the case of the thick FeO layer causes the outer scale to crack off in sections while the pre-war thinner FeO layer does not have a large volume change in weathering, thus continuing the protection offered by the original scale. The removal of scale by weathering during the construction of the ship is dependent on (a) final rolling temperature, (b) atmospheric condition during construction, (c) relative position of plating to prevailing winds. The mill surface presented for application of paint therefore may not be uniform. Author's ferroxyl tests show penetration of paint film by sea-water in less than 2 wks. After penetration the condition may be (a) for continuous scale—no corrosion, (b) for entirely descaled metal—general corrosion, (c) partially descaled—intensified local action with Fe_3O_4 of scale acting as noble element of the cell. In the latter case the action may cause removal of large areas of paint film. The superiority in marine service of pre-war steel plate is therefore considered to be due to the scale and not the base metal. Paint protection on scaled hot rolled plates is increased with increase in number of coats but is never excellent; with descaled hot rolled plates (pickled) excellent performance is obtained with three coats of paint, ideally applied. The use of highly alloyed steels for hull construction even if the price became low enough to justify their use economically, is no solution to problem of ship corrosion since they are even more sensitive to local action than mild steels and would require complete descaling, pickling and polishing. The author advocates use of mild steel, pickled or sandblasted free of scale and painted. Some cost figures are given to indicate the large increase in cost entailed by such procedure at present. In one such case of pickled plating a trawler was in good condition at the end of a period during which a scaled and painted trawler was docked 3 times; the elimination of one docking would more than pay for the pickling operation. The priming coat of paint on pickled metal surface is most critical and for adherence requires dry surface, and removal of loose rust. Subsequent paint films may be applied under moist weather conditions without having adherence suffer. The discussion brings out the prevalence of high corrosion rates in plate material having segregated regions, corrosion aboard ship due to stray currents, etc. Additional data regarding corrosion resistance and protection, as given in the discussion, in general corroborate the results reported by the author. See also *Metals and Alloys,* Vol. 6, Oct. 1935, p. MA419L/7. WB (13)

Destruction of Zinc Gutters and Covers on Paper Roofs (Zerstörung von Zinkrinnen und Zinkbekleidungen auf Pappdächern) F. HUTH. *Korrosion u. Metallschutz,* Vol. 12, Dec. 1936, pp. 350-351. Several years observation of the destruction of Zn on bituminous paper roofs is reported. The joint action of light, air and humidity may be intensified by solar radiation, particularly when the Zn is in contact with tar paper. Ha (13)

Die-cast Metals and Alloys, Report of A.S.T.M. Committee B-6. J. R. TOWNSEND, CHAIRMAN. *Proc. Am. Soc. Testing Materials,* Vol. 36, Pt. I, 1936, pp. 178-181. Progress report.

2 **Appendix I—An Investigation of Aluminum Die-casting Alloys Nos. IVa and Va.** E. E. THUM, CHAIRMAN SUBCOMMITTEE I. pp. 182-192. Report of the corrosion tests on Al alloys containing 5% Si, 1% Fe (IVa) and 12% Si, 1% Fe (Va). Duplicate groups of 5 specimens of each alloy were exposed for each of 3 periods to salt-spray tests at 2 different laboratories and an outdoor alternate immersion tests at one laboratory, and were tested after exposure by 2 laboratories. Unexposed "blanks" were tested with each group of corroded specimens. Among the conclusions

3 were the following: The resistance of alloy Va to salt-spray corrosion, as indicated by losses in tensile strength, is superior to that of either alloy IVa or V. (Alloy V was the 12% Si alloy containing in addition .4% Cu, .25% Mn, .05% Mg, .05% Zn, .3% Ni.) The resistance of alloy Va to salt-spray corrosion does not appear to be as greatly affected by manufacturing differences or variations in exposure conditions as do the resistances of the other two materials. The reductions in tensile strength caused by exposures to the outdoor alternate-immersion test for up to 52 weeks were

4 generally within the limits of experimental error but do indicate a lower resistance to corrosion for alloy V than for alloys IVa and Va. The salt spray is a more severe exposure than the outdoor alternate-immersion test used in this investigation.

Appendix II—Finishing of Die-castings. J. C. FOX. Pp. 193-203. Zn-base and Al-base alloys, comprising 90% of die-castings production, are discussed. Preparation of the surface, electroplating, organic finishes, enameling, polishing, acid-dip treatment and anodic oxidation treatment are covered. For previous report, see

5 *Metals and Alloys,* Vol. 7, May 1936, p. MA 262R/4.

VVK (13)

Stainless Steels, with Special Reference to Corrosion (Om rostfria Stål med speciell hänsyn till deras korrosion) SVEN BRENNERT. *Jernkontorets Ann.,* Vol. 120, Sept. 1936, pp. 587-604. Summary of study tour to U.S.A., England, and Germany in 1935-36. HCD (13)

6 **Destruction of Metals by Cavitation (Die Zerstörung der Metalle durch Hohlsog, Kavitation)** H. N. BÖTCHER. *Z. Ver deut. Ing.,* Vol. 80, Dec 12, 1936, pp. 1499-1503. Original research. See *Metals and Alloys,* Vol. 7, Nov. 1936, p. MA 550R/8. Ha (13)

Exposure Tests of Plating on the Non-ferrous Metals, Report of Joint Committee. WM. BLUM, CHAIRMAN. *Proc. Am. Soc. Testing Materials,* Vol. 36, Pt. I, 1936, pp. 212-218. Outline of

7 exposure tests of plating on non-ferrous metals by a Joint Committee with the Bureau of Standards and manufacturers. Tables of analyses and coatings are given. VVK (13)

The Action of Molten Zinc on Iron and Steel. I. MUSATTI & A. LA FALCE. *Metal Treatment,* Vol. 2, Winter 1936, pp. 171-172, 170. See *Metals and Alloys,* Vol. 7, Nov. 1936, p. MA 538R/9. JCC (13)

8

Increase of the Seawater-corrosion-fatigue Resistance of Steel by Surface Pressure, Nitriding, Case-hardening and by Electrolytic Galvanizing (Steigerung der Seewasser-Korrosionswechselfestigkeit von Stahl durch Oberflächendrücken, Nitrieren, Einsatzhärten und durch elektrolytischen Zinkschutz) A. JÜNGER. *Mitt. Forsch. Amstalt. Gutehoffnungshütte Oberhausen,* A. G., Vol. 5, Jan. 1937, pp. 1-12. Original research. Possibility of increas-

9 ing endurance limit of steel under corrosive influence by surface treatment was tested through 100-200 million cycles up to 40 days duration. Endurance limit in seawater corrosion is 7000-11,000 lbs./in.^{2} Parkerizing, atramentation and metallizing increase this to about 14,000 lbs./in.^{2} Under higher stresses, the protecting coatings begin to crack and corrosion is accelerated. Hot-galvanizing and Pb coating delay the attack for a considerable time but do not increase the endurance limit. Surface pressure increases it considerably in short-time tests, but with longer periods the pro-

10 tective action of the surface compression decreases with the corrosive action. The same is true for case-hardening of both C steel and Cr-Ni steel. The most pronounced improvement was observed in nitrided and electrolytically galvanized steels which showed 57,000-64,000 lbs./in.^{2} endurance limit and no rusting. Electrolytic galvanizing alone raised the endurance limit to 42,700 lbs./in.^{2} Ha (13)

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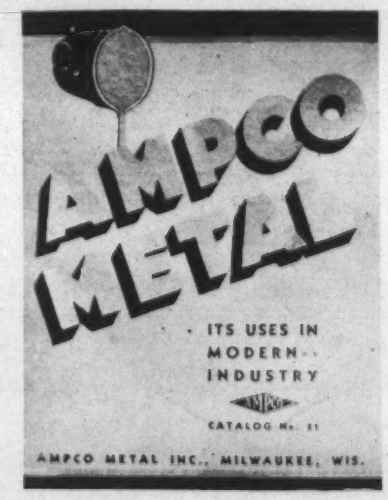

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Milwaukee, Wisconsin

Effect of Solution Composition on the Failure of Boiler Steel Under Static Stress at 250° C. W. C. SCHROEDER, A. A. BERK & EVERETT P. PARTRIDGE. *Proc. Am. Soc. Testing Materials*, Vol. 36, Pt. II, 1936, pp. 721-750; discussion pp. 751-754. Part of an investigation conducted by the Joint Research Committee on Boiler Feed Water Studies and the U. S. Bureau of Mines. Observations in practice coupled with the results of laboratory investigations have led to the general opinion that embrittlement failures in boilers are due to the simultaneous action of 2 factors, an essentially chemical factor depending upon the composition of the boiler water, and an essentially mechanical factor depending upon the stress conditions in the steel. Experimental work indicates that chemically pure NaOH has little effect on the tensile load which a steel specimen will carry, but if the specimen has a line of stress concentration, such as that caused by a groove, chemically pure NaOH definitely decreases the load-carrying ability. The introduction of small amounts of Na silicate into NaOH solutions greatly lowers the load required to produce failure at 250° C. in specimens tested in tension alone, and in specimens suffering a concentration of stress. The lowest concentration of NaOH required to cause failure of eccentric-grooved specimens in Na silicate—NaOH solutions depends to a considerable extent on the load applied to the specimen. Na_2SO_4 retarded the failure of the eccentric-grooved specimens in Na silicate-NaOH solutions only when the load was applied at room temperature. Na sulphite, ordinarily a reducing agent, is reduced by Fe and H at 250° C. 12 references. **The Use of Solubility Data to Control the Deposition of Sodium Sulphate or Its Complex Salts in Boiler Waters.** *Ibid.* pp. 755-768; discussion p. 769. Part of an investigation conducted by the Joint Research Committee on Boiler Feed Water Studies and the U. S. Bureau of Mines. The constituents of a boiler water are believed to exert an important effect upon the cracking of boiler steel. For example Na silicate and NaOH tend to produce embrittlement and Na_2SO_4 tends to inhibit this effect. The results of an extended investigation of the solubility of Na_2SO_4 from approx. 300 to 660° F. in water and in various complex solutions representative of concentrated boiler waters have been used to develop the curves in this paper which express the conditions under which Na_2SO_4 will be deposited during the evaporation of a boiler water of a given initial composition. If further investigation shows that Na_2SO_4 either in solution or as solid is necessary to prevent embrittlement, these curves will define the conditions which can or should be maintained. At the present time the curves cannot be used to control the composition of boiler waters for the prevention of embrittlement unless a number of assumptions are made. Further testing now being carried out should eliminate the necessity for these assumptions and furnish data which will allow direct application in practice. VVK (13)

Contact Effects of Glass and Platinum on the Solution of Iron and Steel in Nitric Acid of Various Concentrations. HIKOZO ENDO & HIDEO KAWASE. *Kinzoku no Kenkyu*, Vol. 13, Sept. 1936, p. 370-381. In Japanese. *Sci. Repts. Tôhoku Imp. Univ.*, Vol. 25, 1936, pp. 755-770. In English. In the first report (*Metals and Alloys*, Vol. 7, Dec. 1936, p. MA 608R/9) it was shown that the point of contact of the Fe specimen with glass was markedly attacked, and the shape was deformed in such a concentrated solution. In this paper, this was confirmed, and the contact effect of Pt wire was also studied. The deformation in shape of Fe due to the contact of glass and Pt wire was also observed in dilute solutions (less than 45%) when Fe was immersed in them for a long period. Anodic attack by electrochemical reaction is negligibly small in a dilute solution. When a small glass plate was placed closely in contact with the surface of an Fe plate, the contact plane remained in its original condition. Chemical, physical and mechanical actions are also involved in the removal of the liquid film of complex salt $[Fe(NO)]$ $(NO_3)_2$ formed on the surface of Fe dissolving in the acid. KT (13)

Resistance of Nickel and Monel Metal to Chlorinated Solvents for Dry Cleaning (Beständigkeit von Nickel und Monelmetall gegen chlorierte Lösungsmittel bei Trockenreinigung) W. MÜLLER. *Korrosion u. Metallschutz*, Vol. 12, Dec. 1936, pp. 349-350. Original research. Cause of attack of Ni and Monel by CCl_4 and $CHCl_3$ is HCl formed by hydrolysis in presence of H_2O; air and light accelerate the effect. Liquid mixture of CCl_4 and H_2O dissolved 0.00012 mm. Ni and 0.00096 mm. Monel per yr., while the gaseous mixture dissolved 0.53 and 0.40 mm./yr. respectively. Comparative rates are given on steel, and by chloroform and by dichlorethylene at different temperatures. Both Ni and Monel show good suitability. Ha (13)

Additions of Inhibitors to Solutions that Corrode Aluminum (Zusätze von schützenden Erzeugnissen zu Lösungen, die Aluminium korrodieren) R. W. MÜLLER. *Korrosion u Metallschutz.* Vol. 12, Oct. 1936, pp. 299-300. Original research. Addition of alkali sulphites, H_2O_2, soap solutions, colloids or nicotin sulphate to the solution was found to reduce or prevent corrosion of Al. Ha (13)

The Rate of Reaction of Sodium Sulphite with Oxygen Dissolved in Water. R. M. HITCHENS & R. W. TOWNE. *Proc. Am. Soc. Testing Materials,* Vol. 36, Pt. II, 1936, pp. 687-694; discussion pp. 695-696. Sodium sulphite is being employed in increasing amounts for the prevention of corrosion of metal surfaces by dissolved O. The reaction rate of sodium sulphite and O in aqueous solutions is a function first of the type of water, second of the temperature and third of the excess of the reagent employed. The reaction proceeds roughly 5 times as rapidly in seawater as in distilled water and 10 times as rapidly in distilled water as in St. Louis city water. It proceeds with great rapidity at 85° C. even in water with strong inhibitory tendencies. In general, a rise of 10° C. doubles the speed of the reaction. A 20% excess of reagent almost doubles the rate of reaction and a 100% excess almost quadruples it. The authors conclude that the reaction proceeds with great rapidity and that it is complete in less than 1 min. at temperatures approaching that of boiling water, regardless of the type of water, if a slight excess of sodium sulphite is employed.
VVK (13)

Determination of Dissolved Oxygen in Boiler Feed Water. ALFRED H. WHITE, CLAUDE H. LELAND & DALE W. BUTTON. *Proc. Am. Soc. Testing Materials,* Vol. 36, Pt. II, 1936, pp. 697-713; discussion pp. 714-720. Progress report of Subcommittee VIII on Standardization of Water Analysis Methods to the Joint Research Committee on Boiler Feed Water Studies. After reviewing previous work on the effect of certain ions upon the accuracy of the Winkler O determination, the authors present an electrometric method of titrating free I as applied to the Winkler method. Experimental work indicates the feasibility of distilling and collecting the dissolved O together with a portion of water distilled from the sample as a method for eliminating non-volatile substances that affect the accuracy of the determination. This applies particularly to waters containing interfering substances. 35 references.
VVK (13)

Corrosion of Iron and Steel, Report of A.S.T.M. Committee A-5. F. F. FARNSWORTH, CHAIRMAN. *Proc. Am. Soc., Testing Materials,* Vol. 36, Pt. I, 1936, pp. 103-106. Progress reports of subcommittees. **Report of Subcommittee VIII on Field Tests of Metallic Coatings.** Pp. 107-113. Observations at Brunot Island (Pittsburgh, Pa.) are reported. Zn-coated specimens electroplated under laboratory conditions were free from rust a little longer than the lightly galvanized sheet specimens. However, if the two are compared on the basis of the time required for 50% of the area to become covered with rust, there is no apparent difference in the protection obtained. The protection of Cd coatings is less than that afforded by Zn coatings of the same weight. Zn coatings on hardware give less protection than Zn coatings of the same weight on sheets. See also *Metals and Alloys,* Vol. 7, May 1936, p. MA 262R/7.
VVK (13)

Study of the Rôle of Inclusions in Corrosion of Steels (Contribution à l'Étude du Rôle des Inclusions dans la Corrosion des Aciers) ALBERT PORTEVIN & LOUIS GUITTON. *Compt. Rend.* Vol. 204, Jan. 11, 1937, pp. 125-127. Review plus original research. The progress of corrosion on polished surfaces of stainless steel (C 0.12-0.35%; Cr 12%) was compared microscopically with plain C steel (C 0.08%) under attack from a series of organic and mineral acids in both alcohol and water solutions. Photomicrographs show the attack sometimes starting at grain boundaries and sometimes at inclusions.
FHC (13)

Reduction of Cylinder Wear. *Journal of Commerce, Shipbuilding and Engineering Edition,* Oct. 8, 1936, page 11. Brief description of new process of protecting cast Fe oil engine cylinders by depositing Cr electrolytically. A very hard surface is obtained resistant to both corrosion and wear. Wear tests on N-hardened and Cr-coated cylinders show the superiority of the latter.
JWD (13)

Experiments with Various Cleansers for Use in Can-washing Machines (Laboratoriumversuche mit verschiedenen Reinigungsmitteln im Hinblick auf die Vorgänge in der Kannenwaschmachine) W. MOHR & WULLHORST. *Molkerei-Zeitung (Hildesheim),* Vol. 50, Oct. 9, 1936, pages 2490-92; Oct. 13, 1936, pages 2525-28. The corrosion action of (1) "alte P_3-zinnfest," (2) "Neue P_3-zinnfest," (3) calcined soda (95-100% Na_2CO_3), and (4) caustic soda, on Al, tinned Fe, and tinned Cu, materials used in milk transport cans, was studied. As in actual practice in can-washing machines, the temp. was 85° C. and the time 12 sec. The concentration of reagents was 0.25%. The composition of reagents (1) and (2) is not given. (1) caused more corrosion on tinned surfaces than on Al, and is not recommended. (3) and (4) were found to be corrosive, and are not recommended unless silicate is added as a corrosion preventive. (2) was found to be satisfactory.
GPS (13)

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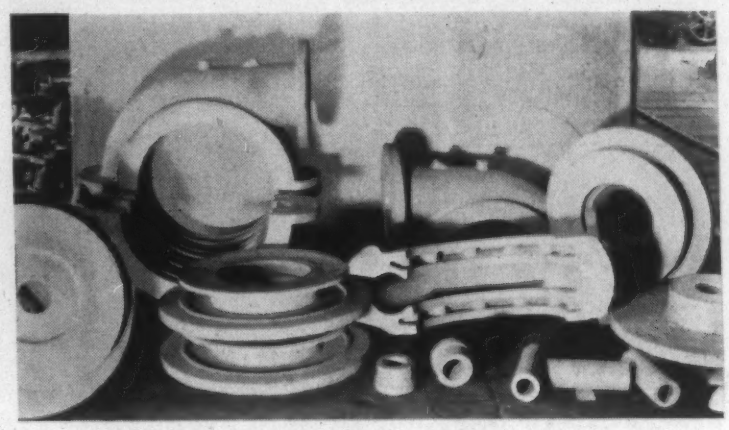

THE above photograph is of Durco KA2SMo castings to be used for three 6″ pumps. The pumps are going into service handling hot sulphite liquors in a digester circulating system.

Such service is one of the toughest, from a corrosion standpoint. Durco KA2SMo was selected as other equipment in this alloy has proved its worth in the same service.

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14. APPLICATION OF METALS AND ALLOYS

Metallurgical Problems Presented in Making Hydrogenation Tubes and Cracking Chambers (Problèmes Métallurgiques Soulévé par la Construction des Tubes d'Hydrogénation et des Chambres de Cracking) CH. BERTHELOT. *Revue de Métallurgie*, Vol. 33, Sept. 1936, pages 566-573; Oct. 1936, pages 619-626; Nov. 1936, pages 677-690; Dec. 1936, pages 727-746. A comprehensive summary of factors involved during operation of equipment used for hydrogenation and cracking, taken from the literature. JDG (14)

How Modern Alloy Metals Provide for More Profitable Manufacturing; [a Symposium]. *Steel*, Vol. 99, Oct. 12, 1936. **Blazing the Trail to Restored Profits,** T. M. GIRDLER, pages 122-123; **Savings with Alloys Universal in Scope,** B. F. FAIRLESS, pages 123, 126; **Light Metals Give Notable Economies,** S. K. COLBY, pages 126, 128; **Effecting Economies in Use of Steel,** QUINCY BENT, page 128; **Modern Alloys Hold Imposing Position,** W. F. DETWILER, pages 128, 131; **Simplification to Aid Alloy Users,** F. A. BIGELOW, page 131; **Custom-built Steel—More Value per Ton,** FRANK PURNELL, pages 131-132; **Solving Problems of Transport Field,** A. W. MACE, page 132. MS (14)

14a. Non-Ferrous

G. L. CRAIG, SECTION EDITOR

Copper and Its Alloys (Le Cuivre et Ses Alliages) J. TÉZENAS. *Cuivre et Laiton*, Vol. 9, Oct. 30, 1936, pages 463-468. Cu ore deposits are discussed and a general review is given of the metallurgy and applications of Cu, brass and bronze. Ha (14a)

The Lining of Bearings. EDMUND R. THEWS. *Mechanical World & Engineering Record*, Vol. 99, May 8, 1936, pages 465-466. Failures of bearing linings are usually blamed on the composition and general properties of the lining metals used. Emphasizes that the strength of a lined bearing is in the shell. Uniform support and proper alignment cannot be ensured or maintained, therefore, without the lining adhering properly to the shell. Correct preparation of the shell and the attainment of correct conditions during lining are essential. WH (14a)

The Resistance Against Atmospheric Influences of Wood Screws of Light Metal (Ueber die Witterungsbeständigkeit von Holzschrauben aus Leichmetall) W. NICOLINI. *Aluminium*, Vol. 18, Dec. 1936, pages 622-623. Wood screws of Al-Cu-Mg, Al-Mg-Si, Al-Mg-Mn and Al-Mg were tested in beech, oak and pine wood. Al-Mg showed the longest life in beech and pine. "Eloxated" screws are more resistant than polished or lacquered screws. Al-Cu-Mg should be used only in dry places. Ha (14a)

Columbite. *Engineer*, Vol. 162, Nov. 13, 1936, page 518. Although this rather rare mineral, which occurs in tin ore, had heretofore been considered useless, it is now being used in the manufacture of stainless steel. The addition of Fe-Cb (containing 50 to 60% Cb) to some Cr-Ni steels reduces the tendency to intergranular corrosion. Stainless steels become more ductile when Fe-Cb is added. Several hundred tons of columbite are used annually in the U. S. LFM (14a)

Plant Expanded to Fill Rapidly Growing Demand for Die Castings. LESTER A. PILLION. *Steel*, Vol. 99, Dec. 28, 1936, pages 43, 54. Describes newer applications of die castings. Expanding demand is due principally to increasing confidence in die-casting alloys and to better finishes. MS (14a)

Lower Expenses for Filtration and Separation by the Use of Monel Metal (Unkostensenkung beim Filtrieren und Trennen chemischer und technischer Stoffe durch Monelmetall-Filtererzeugnisse) RUDOLF MÜLLER. *Chemische Apparatur*, Vol. 23, Nov. 1936, pages 177-181. Filter cloths and screens of Monel Metal were superior to brass in the paper industry and superior to cotton in the sugar industry and in the preparation of alumina. Further examples are given from the food, salt, coal, and rubber industries. HR (14a)

The Permanence of Aluminum-manganese Alloys against Chemical and Atmospheric Influences (Zur Frage der Beständigkeit von Aluminium-Manganlegierungen gegen chemische und atmospherische Einflüsse) W. HELLING. *Aluminium*, Vol. 18, Oct. 1936, pages 473-477. The resistance of Al-Mn alloys to attack by 0.5 and 0.05% NaOH, oxidic NaCl solution, 2% H_2SO_4, 2% H_2SO_3, dilute HCl, SO_2-containing waste gases, 40% acetic acid and steam was investigated. Tabulation of the results upsets general belief that corrosion resistance of Al-Mn alloys is superior to that of pure Al. Mn improves resistance to solution containing Cl^-, but weakens resistance to H_2SO_4, H_2SO_3 and SO_3 containing waste gases, because the β-crystal is more strongly attacked by the S acids than is the α-solid solution. Ha (13)

Rust Protection (Ueber Rostschutz) H. ROTERS. *Mitteilungen des Forschungsinstituts und Probieramts für Edelmetalle*, Vol. 10, Oct. 1936, pages 73-84. Methods used to prevent rusting and corrosion are reviewed. Ha (13)

Non-Metallic Inclusions in Aluminum and Their Influence on its Corrodibility. L. TRONSTAD. *Det Kongelige Norske Videnskabers Selskabs Skrifter*, No. 19, 1935, 19 pages; also *Norges Tekniske Höiskole. Avhandlinger til 25 års Jubileet, 1935*, pages 467-494. Compares Mylius corrosion tests, anodic and cathodic leakage current determinations, sulphur content, sulphur prints and morin prints. Mylius tests were carried out with 1 g. NaCl + 3 g. H_2O_2 per 100 g. H_2O. Solution was allowed to act on degreased specimens, to which glass rings were cemented with a rubber compound to eliminate edge effect, for 24 hrs. at 20° C. Leakage current determinations were made on similarly mounted specimens the other electrode being Pt and the electrolyte 0.05 *N* NaCl 0.0001 *N* $AlCl_3$ buffered to pH 4.7 with *N* acetate and with 0.1 volt for cathodic and 3.0 volts for anodic tests. Sulphur prints were made with moist Agfa Brovira Glossy Hard, backed with moist filter paper and held in contact in a copy press for 10 hrs., afterwards bleached in a ferricyanide bleacher and fixed in a neutral fixing bath. Morin prints were made with bleached washed bromide paper soaked in 3% NaCl + 0.5 ml. 0.4% alcoholic morin solution acting for two hrs. and were examined in ultra violet light. A general correlation between all these tests was observed for 3 qualities of sheet that indicated superficial sulphide inclusions directly or indirectly play a part in the wet corrosion of Al. ABW (13)

Aluminum in Printing Technique (Aluminium in der Drucktechnik) F. HANSEN. *Aluminium,* Vol. 18, Dec. 1936, pages 623-624. "Algraphy" is a flat-printing process in which the Zn plates are replaced by Al. Two etching methods to prepare the Al plates for printing are described. A particular advantage of Al over Zn plates is that the latter often contain Pb inclusions, which show up in printing. Ha (14a)

Applications of Light-metal Alloys in the Automobile (Les Applications des Alliages légers dans la voiture automobile, Salon de l'Automobile à Paris 1936) J. J. BARON. *Revue de l'Aluminium,* Vol. 13, Nov. 1936, pages 413-424. A survey. HR (14a)

14b. Ferrous

M. GENSAMER, SECTION EDITOR

Aging of Various Materials Used for Anchor Chains (Sull' Invecchiamento di Alcuni Materiali usati per la Fabbricazione delle Catene per Ormeggio delle Navi) RAFFAELE ZOJA. *Atti Accad. Sci. Torino,* Vol. 71, Jan.-Apr. 1936, pages 241-253. Original research. Chains have always been made from puddled Fe, but recently attempts have been made to use extra mild steel instead. 15 samples were tested: 4 puddled Fe, 3 homogenized Fe, and 8 extra mild steels. These were all given aging tests by making up links (2.5 cm. diam.), testing the breaking strength, and then heating 6 hrs. at 250° C. to age them. These were then given a resiliency test, the work absorbed in breaking each being measured. The tests show that both puddled and homogenized Fe are very sensitive to aging. Mild steel ages less but the critical zone occurs at low deformations. Addition of Cu improves aging qualities, although some poor results have been obtained, so that at present the effect of addition of Cu to steels is still uncertain. AWC (14b)

Take a Look at Materials. N. B. MACLAREN. *Steel,* Vol. 99, Aug. 24, 1936, pages 42-44. Cites 2 cases to illustrate how change in material or heat treatment may answer increasing demands of machine-tools with least possible expense. MS (14b)

Cast Ferrous Materials for Chemical Equipment (Gegossene Werkstoffe der Eisen-gruppe für den Bau Chemischer Geräte) H. JUNGBLUTH & H. MÜLLER. *Chemische Fabrik,* Vol. 9, Jan. 22, 1936, pages 41-46. Heat and corrosion-resisting cast Fe and steels for application in chemical industry include high Si-Fe, Fe-Cr-C, Fe-Cr-Ni-C, low C Fe-Ni and Fe-Ni-Cu alloys, all of which are discussed and their applications and limitations illustrated. FPP (14b)

Steelwork in Buildings—Thirty Years' Progress. S. BYLANDER. *Structural Engineer,* Vol. 15, Jan. 1937, pages 2-25. Detailed description of relation of design to the use of steel from the civil engineering viewpoint. Welding has not been widely used in new steel buildings. There have been some applications of welding to strengthen weakening sections. The recent use of high tensile alloy steel in a certain building is described. FPP (14b)

Steel Scaffolding. P. M. ANDREWS. *Structural Engineer,* Vol. 14, Dec. 1936, pages 490-505. Describes the materials, construction and, particularly, the coupled joints used for the steel scaffolding erected for repairs to the clock tower of Palace of Westminster, London. FPP (14b)

Structural Alloy Steels in the United States. *Engineer,* Vol. 162, Dec. 25, 1936, page 693. Brief note outlining the uses of various alloy steels in buildings and bridges in the U. S. LFM (14b)

Handling Methods Employed in Assembling Steel Desks. C. W. HAMILTON. *Steel,* Vol. 99, Dec. 21, 1936, pages 45-46, 74. Outlines operations involved in manufacture of steel office furniture in plant of Globe-Wernicke Co., Cincinnati, O. Spot welding is used to a great extent. For certain operations, oxyacetylene and arc welding are used. MS (14b)

Heat-enduring Alloys Aid in Casting Huge Telescope Disc. R. STUART BROWN. *Industrial Heating,* Vol. 4, Jan. 1937, pages 37-38. Cores in the glass mold were held in place by anchors of Calite (26% Cr, 10% Ni) which successfully withstood the temperatures of molten glass, destructive to other materials. Ha (14b)

Trailers Stage National Show; 50,000-ton Steel Market. *Steel,* Vol. 99, Nov. 9, 1936, pages 28-29. Describes several types of construction showing tendency toward increased use of steel, and estimates consumption of steel by the industry in 1937. MS (14b)

15. GENERAL

Technical Developments in German Iron and Steel Production During the Last Fifteen Years. FRITZ SPRINGORUM. *Iron Steel Inst., London,* Sept. 1936, Advance Copy No. 1, 28 pp. **(Die technische Entwicklung der deutschen Eisen- und Stahlerzeugung während der letzten fünfzehn Jahre)** *Stahl u. Eisen,* Vol. 56, Sept. 17, 1936, pp. 1042-1063. *Blast Furnace Steel Plant,* Vol. 24, Oct. 1936, pp. 876-878; Nov. 1936, pp. 973-974, 976-977; Dec. 1936, pp. 1080-1081, 1102-1103. Reviews economics of Fe and steel production in Germany and discusses recent economies and improvements. Briefly discusses improvements in rolling mills. Quality of products has been increased by better supervision and by extensive research. Problems of the future are briefly discussed. JLG + MS + SE (15)

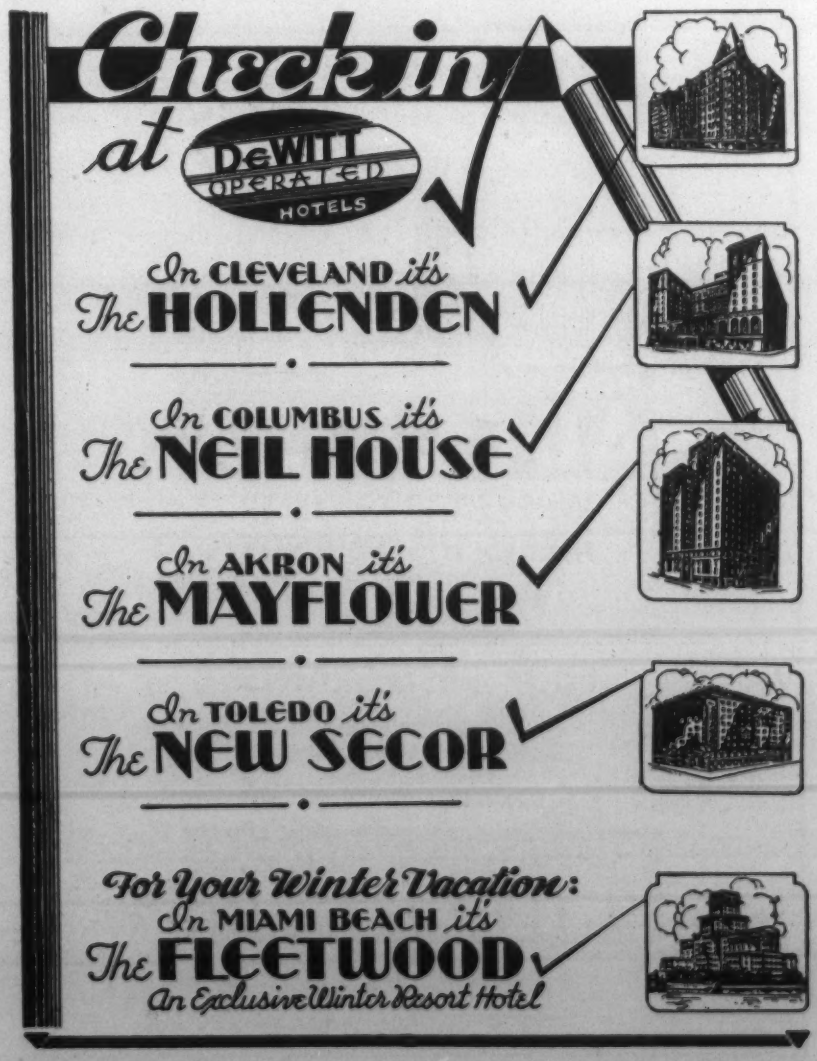
Miracles of Modern Research. L. W. CHUBB. *Heat Treating and Forging,* Vol. 22, Nov. 1936, pages 564-566. Paper read before Pacific Coast sections of the American Institute of Electrical Engineers. Describes some developments of Westinghouse Research Laboratories. Among those of metallurgical interest are "Konal," "Kovar," and "Cupaloy." MS (15)

Nickel Research Laboratories. *Electrical Review,* Vol. 119, Oct. 30, 1936, pages 597-598. Description of laboratories of the Mond Nickel Co., Ltd., at Birmingham, Eng., with chief attention to electrical testing equipment and electrical distribution. MS (15)

Ferrous Industry of Powys. *Times [London] Trade & Engineering,* New Series, Vol. 40, Dec. 1936, page 15. Describes several Fe and steel plants in North Wales, with chief attention to those of Brymbo Steel Co. MS (15)

Copper Refining and Manufacture. *Times [London] Trade & Engineering,* New Series, Vol. 40, Dec. 1936, page 16. Brief description of 3 works in South Wales. MS (15)

Zinc Smelting. *Times [London] Trade & Engineering,* New Series, Vol. 40, Dec. 1936, page 19. Deals with progress of National Smelting Co., Swansea, Wales. MS (15)



Iron and Steel Production. *Electrical Review,* Vol. 119, Dec. 18, 1936, pages 845-848. Describes works of Guest Keen Baldwin's Iron & Steel Co., Ltd., Cardiff, Wales, with particular attention to the electrical equipment. MS (15)

Metallurgical Development and Engineering Progress. *Engineering,* Vol. 142, Dec. 25, 1936, pages 695-696. From the presidential address by Sir William J. Larke read before the Royal Society of Arts, London, Dec. 11, 1936. LFM (15)

New Gold Fields of Tanganyika and the Development of Gold Mines therein (Die neuen Goldfelder Deutsch-Ostafrikas (Tanganyika Territory) und die Entwicklung des dortigen Goldbergbaus) K. STIER. *Metall und Erz,* Vol. 33, June 2, 1936, pages 317-320. Detailed report on geographical distribution, nature of deposits and production data of German colonial gold fields. FPP (15)

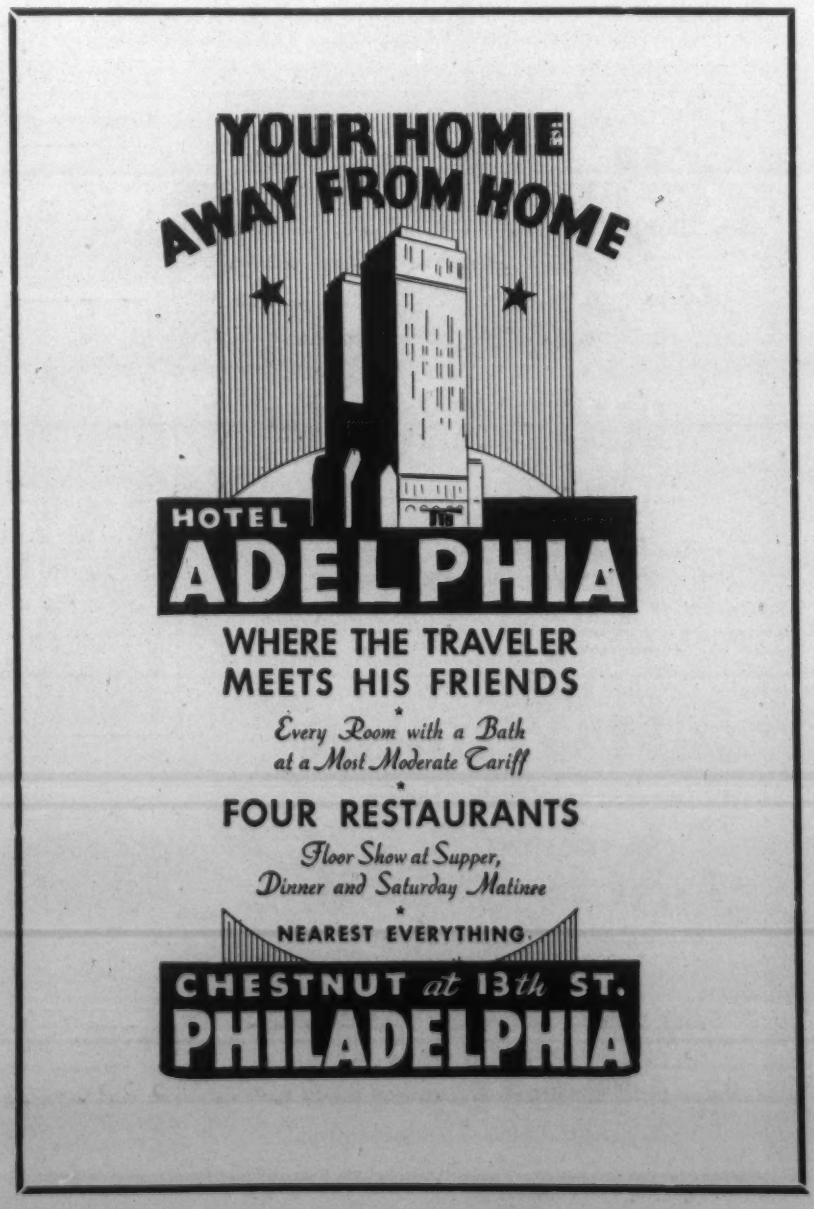
15a. Economic

Testing and Measuring as Presupposition for Technical Progress (Prüfen und Messen als Voraussetzung technischen Fortschritts) C. RAMSAUER. *Z. Ver. deut. Ing.,* Vol. 80, Nov. 28, 1936, pp. 1429-1432. Quantitative measurement as basis of applied natural science, effect on production methods, and limits of accuracy are discussed. Ha (15a)

The Nickel Industry in 1936. ROBERT C. STANLEY. *Can. Mining J.,* Vol. 58, Jan. 1937, pp. 23-25. *Blast Furnace Steel Plant,* Vol. 25, Jan. 1937, pp. 83-84. **Increasing Use of Nickel.** *Elec. Rev.,* Vol. 120, Jan. 8, 1937, p. 60. A statistical review of the operations of the Intern. Nickel Co. WHB + MS (15a)

Steel and the American Farmer. T. M. GIRDLER. *Blast Furnace and Steel Plant,* Vol. 24, Nov. 1936, page 991. Excerpt from address before the Farm Equipment Institute. MS (15a)

Progress in Steel. E. G. GRACE. *Iron Age,* Vol. 139, Jan. 7, 1937, pages 60-63. Economic. Discusses trends and future needs and possibilities. VSP (15a)



Foundry Equipment and Supplies. T. G. JOHNSTON. *Iron Age,* Vol. 139, Jan. 7, 1937, pages 681-683, 686-687. Improvements in gray Fe foundry technique forced by competition from steel and concrete are described. VSP (15a)

The British Iron and Steel Industry in 1936. A. K. MCCOSH. *Iron & Coal Trades Review,* Vol. 134, Jan. 15, 1937, page 108. Review. Ha (15a)

Steel Mill Equipment. T. C. CAMPBELL. *Iron Age,* Vol. 139, Jan. 7, 1937, pages 479-481, 484, 486, 488-490. Review of advances throughout the industry. VSP (15a)

Continuous Strip Mill. T. C. CAMPBELL. *Iron Age,* Vol. 139, Jan. 7, 1937, pages 131-134. Review of expansion in this field. Includes a table listing continuous sheet and wide strip mills installed or under construction in the United States with approximate capacity. VSP (15a)

Random Thoughts of an Idle Steel Man. FRANK H. CROCKARD. *Iron Age,* Vol. 138, Dec. 17, 1936, pages 32-37, 45; Dec. 24, 1936, pages 19-23, 60; Dec. 31, 1936, pages 26-29, 39. Discusses the technological changes in the manufacture of steel in the United States, the changes in types of products produced and influence of these products on consuming industries, criticizes a number of existing practices and suggests fields for improvement. VSP (15a)

Iron and Steel Trade in Australia. *Iron & Coal Trades Review,* Vol. 134, Jan. 8, 1937, page 48. Statistics on ore deposits, production, producing companies, foreign trade, and general industrial conditions. Ha (15a)

The Non-Ferrous Metals in 1936. *Iron & Coal Trades Review.* Vol. 134, Jan. 15, 1937, pages 134-135. Review of market and production conditions for ores and metals. Ha (15a)

The Belgian and Luxemburg Iron and Steel Trade in 1936. *Iron & Coal Trades Review,* Vol. 134, Jan. 15, 1937, pages 130-131. Ha (15a)

German Iron & Steel Industry in 1936. *Iron & Coal Trades Review,* Vol. 134, Jan. 15, 1937, pages 128-129. Ha (15a)

French Iron & Steel Industry in 1936. *Iron & Coal Trades Review,* Vol. 134, Jan. 15, 1937, pages 129-130. Ha (15a)

French Producers Numbed by Political Unrest. LEON JAUDOIN. *Steel,* Vol. 100, Jan. 4, 1937, pp. 370-372. Reviews conditions in the Fe and steel industry during 1936. Gives statistics on average monthly production, imports and exports for 1913, 1933—Oct. 1936. See *Metals and Alloys,* Vol. 6, June 1935, page MA 262R/4 and Vol. 7, Aug. 1936, page MA 424L/2. MS (15a)

Direct Fired Heating Systems for Steel Mills. LEIF LEE. *Blast Furnace & Steel Plant,* Vol. 25, Jan. 1937, pp. 134, 140. Replacement of steam systems by direct hot-air systems for heating warehouses and mills will reduce heating costs greatly. MS (15a)

15b. Historical

Mining in New Greece (Der Bergbau in Neugriechenland) JOACHIM H. SCHULTZE. *Metall und Erz,* Vol. 33, July 1936, pages 373-379. Geologic and historical considerations and literature on the subject are reviewed. FPP (15b)

The Condition of Luxembourg's Iron Industry 200 Years Ago (Die Lage der Luxemburgischen Eisenindustrie und Wirtschaft vor 200 Jahren) H. VAN HAM. *Revue Technique Luxembourgeoise,* Vol. 28, Nov.-Dec. 1936, pages 117-119. Brief historical sketch of general industrial conditions and mineral resources. Ha (15b)

Mining in British Columbia During 1936. H. J. NICHOLS. *Can. Mining J.,* Vol. 58, Feb. 1937, pp. 73-77. A review. WHB (15b)

Observations and Notes on the Method of Ancient Gold Mining in Southern India. L. MUNN. *Trans. Mining Geol. Inst. India,* Vol. 30, Feb. 1936, pp. 103-110. Historical. APS (15b)

Development of Electroplating. D. J. MACNAUGHTON. *Chem. Trade J.,* Vol. 99, Sept. 18, 1936, p. 237; *Electrical Review,* Vol. 119, Sept. 25, 1936, p. 405. Historical review. MS (15b)

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Book Reviews

DURALUMIN AND ITS HEAT-TREATMENT.

P. Litherland Teed.

Charles Griffin & Co., Ltd., London, 1937. Cloth, 6¼ x 9 in., 116 pages. Price, $6.00.

Major Teed, late Royal Air Force, has used this small volume and its 61 tables as a vehicle for presenting the results of extensive experiments on the heat treatment of duralumin. According to the author's statement, the book is not intended for metallurgists but for engineers, so the author's metallurgical and philosophical doubts on the prevailing theory of the heat treatment process are not of great moment. One looks in vain, however, for any account of the substantial amount of work on the subject published in this country. In fact, the pioneering contributions of Merica, Waltenberg and Scott are dismissed with a single sentence.

While the author has given in great detail the effect of heat treatment conditions upon mechanical properties, he makes no mention, for example, of their effect upon resistance to corrosion. For this reason, and because the book largely reflects the somewhat limited experience and experiments of the author, the book can hardly serve as a handbook to the user of duralumin.—JUNIUS D. EDWARDS.

CASTING MANUAL FOR NON-FERROUS METALS.

Sam Tour and W. J. Reardon

Metal Industry Pub. Co., New York, 1937. Paper, 5¼ x 7⅞ in., 50 pages. Free, on application to the publisher.

This is the second edition of the volume previously called "Brass Founders' Manual," which appeared in 1935. Concise information is presented on casting alloys, sands, melting practice, etc., for alloys with a base of Cu, Al, Ni or Mg, die casting alloys, etc. Much is taken, with acknowledgement, from the American Foundrymen's Association "Cast Metals Handbook."—H. W. GILLETT.

INTRODUCTION TO PHYSICAL METALLURGY. 3D EDITION.

Walter Rosenhain.
Revised and partly rewritten by
J. L. Haughton.

D. Van Nostrand Co., New York, 1935. Cloth, 5½ x 8¾ in., 368 pages. Price $8.00.

This is essentially a reprinting of Rosenhain's well-known text. Comparison with the second edition, printed in 1916, shows the present edition to be an amended rather than a revised edition; the chapters on the thermal study of metals and alloys, the equilibrium diagram, microstructure and the equilibrium diagram, and on typical alloy systems have been extended somewhat. The present edition can hardly be considered a modern treatise on this important subject. Perhaps by way of history it might serve a purpose, but this purpose is better served by the earlier editions. —R. F. MEHL.

TOOL STEEL SIMPLIFIED

Frank R. Palmer

Carpenter Steel Co., Reading, Pa., 1937. Cloth, 6¼ x 9¼ in., 316 pages. Price $1.00 in U. S., $3.50 elsewhere.

This is "a handbook of modern practice for the man who makes tools." Somebody will soon have to coin a name for a type of book that is becoming increasingly common, the type that gives real engineering information, broadly applicable, yet written from the point of view of one producer and having as its object the sale of that one producer's good. This book is of that type, and a very good one.

Anyone who tries to write technical information for the shop man with practical experience but without theoretical training has a tough job in being clear, accurate, and interesting to such readers all at the same time, and doing it without too much baby-talk. Now and again the author skates on thin ice in respect to baby-talk, but he probably escapes irritating the type of reader for which it is intended.

The book isn't planned as a text-book, but if we were to give a course in metallurgy in a university we would include it as required reading, partly as an example of logical technical writing, partly for the information contained, but mostly to give the budding metallurgist a feeling of the psychology of the practical workman.

To the metallurgist the high spots of the book are the discussions of deep etching, of "timbre" testing, i.e. grain coarsening and hardenability, and of torsion impact. Based on the torsion impact data, drawing times and temperatures are recommended to reach the peak on the torsion impact curve. While Palmer goes far in accepting the torsion impact results as indicative of service results, he takes care to point out that they may not correctly reflect the relative toughness of different types of steels.

Spark testing is dealt with in some detail and plates shown for various classes of Carpenter steels. Decarburization is featured, the palliative usually being to remove the bark. Controlled atmospheres are dealt with but inadequately discussed since moisture removal is not mentioned. The atmospheres recommended are aimed to reduce scaling but are kept rather strongly oxidizing in order to escape decarburization. True bright hardening is apparently not contemplated.

Emphasis is put on a "tough timbre" 1.10% C water hardening steel as the main reliance for tools and a shift to other steels is deprecated until complete necessity for a change is proven. If greater toughness is desired 0.50% C, 1% Si, 0.5% Mo, water hardened, is advocated, while for greater wear 1.30% C, 3.5% W, water hardened is suggested. If dimensional changes urge a shift to oil hardening steels, 0.90% C, 1.60% Mn is the standard, with 0.75% C, 1% Cr, 1.75% Ni for toughness and 2.10% C, 12.50% Cr, 0.50% Ni for hardness.

If red hardness is desired, as in die steels, 0.30% C, 4% Cr, 14.50% W, 0.50% V is used, with 0.55% C, 1.50% Cr, 2.50% W, 0.35% V for greater toughness, and regular high speed 0.70% C, 3.75% Cr, 18.50% W, 1.10% V for wear at high temperatures. In the text Mo high speed is, however, characterized as "very satisfactory." Hardening procedures for all nine selected compositions are given. Warpage, volume changes and stresses introduced in hardening are interestingly treated. There is plenty of sound, practical comment on tool design and on hardening kinks.

The incorporation of the catalog phase doubtless accounts for the low price at which the book is sold. Either the tool maker or the metallurgist will find it a big dollar's worth.—H. W. GILLETT.

THE GERMAN PATENT POSITION OF ARC WELDING ELECTRODES, COVERINGS, WELDING RODS AND FLUXES. English Edition. W. H. Simon

Institute of Welding, London, 1937. Board, 8 x 11¼ in., mimeographed, 80 pages.

Besides arc welding electrodes, gas welding rods and fluxes are included, and the welding of Cu and Al alloys as well as steel is considered; 116 issued German patents and 24 applications "open for inspection," are listed. Of the former only half are still in force, since in Germany annual taxes must be paid to keep a patent operating, so those of little value die a natural death. The dates of application, of issuance, and the expiration date on expired patents are given, up to March 23, 1937. The claims are summarized, and the patents are indexed under technical classifications, also under the firms to which they are assigned.—H. W. GILLETT.

MATERIALS USED IN HIGH VACUUM TECHNIQUE *(Werkstoffkunde der Hochvakuumtechnik)*

W. Espe and M. Knoll

Julius Springer Verlag, Berlin, 1936. Cloth, 6¾ x 10 in., 383 pages. Price 48 RM.

This book replaces qualitative observations and empirical considerations prevailing in the field of high vacuum technique with sound quantitative data. The authors, well known contributors to this science, are well qualified to undertake this work, which is written from the practical point of view, and deals, not with electronic theories nor the apparatus itself, but with the materials used. No book on this phase of the subject had previously been available.

Much scattered information is critically sifted and systematically compiled. Each important vacuum tube material is considered in an individual chapter treating its processing from the raw material to the finished tube part, as well as those physical and chemical properties of the material that are related to its ultimate application in the tube. The following materials are covered: (1) High melting metals and their alloys (W, Mo, W-Mo, Ta, Cb); (2) Pt-metals and alloys; (3) base metals (Ni, Fe, Cu, Al, Ag, Be, Zr, Ti); (4) alloys of base metals (Fe-Ni, Fe-Cr), high Ni alloys, high Cu alloys, alloys of base metals with the metals listed under (1). Other chapters discuss Hg, alkali and alkaline earth metals, graphite, glass, quartz, ceramics, luminescent materials, mica, asbestos, rubber, gases and vapors, sealing fats, oils, waxes, cements, etc. Of the 383 pages, 110 are devoted to metallic materials including the alkali and alkaline earth metals, and a few pages deal with metallography, laws of plastic deformation and effect of high temperatures. Such sketchy notes, of course, offer nothing new to those engineers that have had a metallurgical training. However, metallurgical information relating to the manufacture of vacuum and gas-filled tubes is scattered throughout the highly specialized book.

The volume is profusely illustrated, superbly printed and bound, and completely indexed and annotated. There are 19 full pages of references no more German in character than would be those of an equally well-informed American author on this subject. In the bibliography, a catch-word indicates the subject of each reference, a very commendable practice. The unusually high price of the book may be due to the highly specialized nature and potential limited use of the volume, and the prospect that this pioneering work in a rapidly expanding field may be out of date in a few years. There are, however, many engineers who desire to enlarge their private libraries with excellent, fully up-to-date books, even though they be only distantly related to their own fields of daily work; this volume, in spite of its high price, may still merit their consideration in view of the compressed nature of its contents—waste space has been kept to an absolute minimum.

This book, unrivalled in its field, can be warmly recommended to vacuum tube engineers, research physicists and metallurgists engaged in the development, production or application of electronic tube materials.—ERICH FETZ.

YEARBOOK, 1937, GERMAN ENGINEERING SOCIETY *(V. D. I. Jahrbuch 1937, Die Chronik der Technik)*

Edited by A. Leitner.

VDI—Verlag G.m.b.H., Berlin, 1937. Paper, 5¾ x 8¼ in., 228 pages. Price 3.15 RM.

Tabloid comment on engineering progress in 1936 as shown by technical literature. It is something like Industrial Arts Index on a smaller scale. An article with the name, date of issue and page of the journal in which it appeared shown in the margin beside the comment, is boiled down to a few sentences, usually one only and a few such comments collected into a paragraph. For example, the principle of the Perrin process is stated in 2 inches high of lines 3 inches long (since the margin takes up nearly half the width of the page). As another, "brass with a small As addition is used for condenser tubes and has shown good service in a 4½ year trial."

Each small section has been assembled by an engineer familiar with the field. The section titles are too numerous to mention since they cover all fields of engineering. The purely metallurgical sections are but a small part of the whole, for instance the section on welding covers but two pages. It is by no means even an approach to a complete bibliography since only perhaps one reference in thirty is to other than German publications. As a finding list to recent German advances over the broad engineering front, the pamphlet has value.—H. W. GILLETT.

HARDNESS OF METALS. F. C. Lea *(Univ. of Sheffield)*

Charles Griffin & Co., Ltd., London, 1936. Cloth, 6¼ x 9 in., 141 pages. Price $6.00.

This is a rambling account of laboratory experience with and tests upon a variety of hardness testers used in England including the Firth, Avery and Herbert. From his tests the author draws conversion curves, some of which differ materially from those given by many other authorities, particularly in the case of the scleroscope. It is unfortunate that more data from other sources were not included for comparison. Despite this omission, which makes it necessary to discount some of the information, there is much of interest; for example curves are given showing that with a worn Rockwell diamond cone, Rockwell C values some 6 points low were obtained over most of the range, as compared with readings with a new cone.

The author apparently deals with nothing that has been done by anyone besides himself, so in his discussion of hot hardness he omits the use of carbide balls or of the mutual indentation method. Random thoughts and experiments in other fields are included, such as stress strain diagrams that are tied in with the main theme only by the fact that hardness determinations were made. Some studies on distribution of hardness in hot drawn rod and cold drawn wire are reported.

The book is useful, but not as thorough nor authoritative as one would have expected Professor Lea to write.—H. W. GILLETT.

METALLOGRAPHY OF ALUMINUM BRONZE *(Metallografia dei Bronzi d'Alluminio)*

C. Panseri

U. Hoepli, Milan, 1937. 7 x 5¾ in., 614 pages. Price 90 lire.

This monograph on aluminum bronze deals with its subject in much the same way and with much the same degree of completeness as the monographs of the "Alloys of Iron" series deal with theirs. Not only is the information collected from the world literature fully summarized, but additional information and many fine micrographs are included from the author's own work. The book contains 750 illustrations, 84 tables and 800 references. The text and illustrations are very well printed. Some two dozen of the illustrations are in colors, and show some of the microconstituents far better than a word description, while the illustrations of corroded alloys show the colors in superb fashion.

The Cu-Al equilibrium diagram is discussed in detail, the ternary systems Cu-Al-Sn, Cu-Al-Zn, Cu-Al-Mn, Cu-Al-Fe and Cu-Al-Ni at some length, and a variety of other ternary and more complex systems, less extensively. The thermal treatment of the plain aluminum bronze and of alloys containing up to considerable amounts of Fe, Ni, Mn or Si is discussed from both theoretical and practical viewpoints, and copiously illustrated with micrographs. Some of the alloys can be hardened to above 300 Brinell. The static mechanical properties, the endurance properties, many different physical properties and the resistance to corrosion are discussed at length.

Under foundry practice, the requirements as to pouring without creating a foam and the gating of these materials of high solidification shrinkage (using, among others, a number of illustrations from the A.F.A. Cast Metal Handbook) are thoroughly discussed. The lost wax process for statuary, especially in relation to casting aluminum bronze, is described in some detail. Extrusion, hot pressing and rolling hot and cold, machining and welding are all discussed.

Specifications set up for aluminum bronze are given in an appendix. Any metallurgist with even a meager reading knowledge of Italian will find the volume a real addition to his library. It represents a vast amount of compilation which is extremely well done because the author knows his subject. There is a need for monographs of this sort on the copper-base alloys. We can be thankful that the urge to replace imported tin by Italian aluminum as an alloying element for bronze has brought about the writing of so good a volume.—H. W. GILLETT.

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A pamphlet devoted to Chapmanizing compares it to nitriding and carburizing. The Chapman Valve Mfg. Co., Indian Orchard, Mass. (B 818)

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Bulletin R-1 which states that this company's rolled manganese steel follows precisely the "Hadfield Formula" also contains list of applications. Manganese Steel Forge Co., Philadelphia, Pa. (B 819)

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Data on different types of molybdenum steels are given in an illustrated booklet of the Climax Molybdenum Co., New York, N. Y. (B 824)

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Bulletin No. 11, superseding Bulletin No. 6, is devoted to the large coreless induction furnaces of the Ajax Electrothermic Corp., Trenton, N. J. (B 825)

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An attractive booklet "Aluminum in Shopfitting and Display" contains a section devoted to practical points on use and fabrication. Arthur Seligman & Co., Inc., New York, N. Y. (B 826)

Testing Machines

Catalog 50, Part L, features Olsen Universal testing machines. Complete descriptions and illustrations. Tinius Olsen Testing Machine Co., Philadelphia, Pa. (B 827)

Thermal Analyzer

Laboratory furnace equipment for grain size tests, creep tests, thermocouple calibration, etc., and for precision heat treatment, is described in a brochure. Stanley P. Rockwell Co., Chicago, Ill. (B 828)

Combustion Tube Furnaces

Tube furnaces, made in two types—hinged and solid—are described and illustrated in Bulletin HD 1236. Hevi Duty Electric Co., Milwaukee, Wis. (B 829)

A. W. 70-90

This bulletin describes the new high-strength "70-90" steel in sheets and plates. Alan Wood Steel Co., Conshohocken, Pa. (B 830)

Nitralloy and Nitricastiron

Leaflet describing three groups of Nitralloy also discusses "Nitrard" and "Nitricastiron." The Nitralloy Corp., New York, N. Y. (B 831)

MANUFACTURERS' LITERATURE

Wellman Magazine

Items of interest and humor are contained in this monthly paper published by The Wellman Bronze and Aluminum Co., Cleveland, O. (B 832)

Mallory Elkon

Looseleaf catalog containing engineering data, descriptions, etc., on electrical contacts for all types of service. P. R. Mallory & Co., Inc., Indianapolis, Ind. (B 833)

Heat and Corrosion Resistant Alloys Heated by Gas

Bulletin C1-A illustrates a number of complex castings made from Q-alloys which are recommended for pipe fittings, furnace parts, etc. General Alloys Co., South Boston, Mass. (B 834)

Electric Heating Elements

A bulletin from this company is devoted to their electric heating elements and terminal accessories for industrial applications. Globar Div., Carborundum Co., Niagara Falls, N. Y. (B 835)

The Jetal Process

Simple immersion in an aqueous bath for about 5 minutes colors all grades of common iron or steel a brilliant and uniform jet black. It is claimed it does not alter dimensions of articles and cannot chip, scale, peel or discolor. Alrose Chemical Co., Providence, R. I. (B 836)

Repeated Stress Machines

These machines for determining the endurance limits of bar, wire and sheet metals are described in a pamphlet of G. N. Krouse, New Kensington, Pa. (B 837)

Rocking Furnace

Type G-M is a small-scale indirect arc electric furnace designed for iron, steel, brass, copper and nickel alloy. Detroit Electric Furnace Co., Detroit, Mich. (B 838)

Bimetal

A simplified version of its manufacture and the way it works is contained in this pamphlet. W. M. Chace Co., Detroit, Mich. (B 839)

Dolomite Refractories

This interesting pamphlet presents the case of Clinkered vs. Calcined Dolomite in the basic open-hearth steel furnace. Basic-Dolomite, Inc., Cleveland, O. (B 840)

Liquitol

Bulletin A1-16-A deals with the use of Liquitol for iron and steel castings and ingots. Alpha-Lux Co., Inc., New York, N. Y. (B 841)

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This company claims that its materials are manufactured by special processes providing a closer metallurgical control than has been obtainable heretofore. Rustless Iron and Steel Corp., Baltimore, Md. (B 842)

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In addition to the 14 standard designs, this company will manufacture baskets to specifications. C. O. Jelliff Mfg. Corp., Southport, Conn. (B 843)

Foote-Prints

Interesting articles as well as information on Foote products are included in the various issues of this house organ. Foote Mineral Co., Philadelphia, Pa. (B 844)

Yoloy

A colorful bulletin summarizes the properties of the above alloy steel. Youngstown Sheet and Tube Co., Youngstown, O. (B 845)

Electric Air Tempering Furnace

Comparative costs in operation of the new air tempering furnace and the old salt bath show a distinct saving by the use of the new furnace, as well as improvement in quality and uniformity, according to Leaflet 36A of the American Electric Furnace Co., Boston, Mass. (B 846)

Colmonoy

Bulletin No. 50 is devoted to the wear-resistant, corrosion-resistant and heat-resistant alloys and overlay metals of the Colmonoy Co., Los Nietos, Calif. (B 847)

Granite City Hi-Yield 1 and 2

This company offers two types of high elastic steel for use where abrasion resistance is required. Granite City Steel Co., Granite City, Ill. (B 848)

Car Hearth Furnaces

Bulletin C-736 is devoted to these furnaces which were designed for uniform heating, sturdy construction and fuel economy. The Philadelphia Drying Machinery Co., Philadelphia, Pa. (B 849)

Impact Tester

The Riehle "VV" variable velocity impact tester is the subject of a booklet of the Riehle Div., American Machine & Metals, Inc., New York, N. Y. (B 850)

Industrial Furnaces

Oil, gas and electric furnaces are described and illustrated in Catalog No. 6 of the Mahr Manufacturing Co., Minneapolis, Minn. (B 851)

Meehanite Metal

A specification chart of recommended grades for various service requirements has been issued by the Meehanite Metal Corp., Pittsburgh, Pa. (B 852)

Ferrocarbo

This material containing both silicon and carbon combined in the form of silicon carbide acts as a graphitizer or softener when added to cast iron. Carborundum Co., Niagara Falls, N. Y. (B 853)

Electric Furnace

The Sentry Model "Y" which is described in Bulletin 1019 is offered especially for hardening small tools. The Sentry Co., Foxboro, Mass. (B 854)

Riveting Aluminum

A booklet which states that riveting is a satisfactory method of joining aluminum and its alloys contains useful data on this subject. Aluminum Co. of Amer., Pittsburgh, Pa. (B 855)

Value of Draft Control

Bulletin No. L-125 points out the value of this company's control which consists of a draft switch, a damper motor and a manual station. Shallcross Controls, Inc., Milwaukee, Wis. (B 856)

Spectrometric Equipment

Catalog D-221 is devoted to the above equipment. Basic theory and designs are described. Bausch & Lomb Optical Co., Rochester, N. Y. (B 857)

Midvaloy No. 77

An unusual oil hardening alloy steel for use in ball races, balls and bearings, taps and tapper taps, etc., is described in a leaflet of The Midvale Co., Nicetown, Philadelphia, Pa. (B 858)

Everdur

This metal is a high strength, non-magnetic, non-sparking alloy of the solid solution type composed of copper, silicon and other controlled elements, according to this illustrated leaflet. American Brass Co., Waterbury, Conn. (B 859)

Properties of OFHC Cooper

An attractive booklet contains reprints of three papers relating to the above subject. United States Metals Refining Co., New York, N. Y. (B 860)

Sixteen Sins of the Cleaning Room

Are listed in a circular for convenience in checking on cleaning rooms. Great Lakes Foundry Sand Co., Detroit, Mich. (B 861)

Cataloy Lead Bronze

This process which is guaranteed to perfectly combine copper and lead in your own plant is described in literature from Cataloy, Los Angeles, Cal. (B 862)

Vanadium Steels

Various of these steels for locomotive and car construction are described in a booklet. Vanadium Corp. of America, New York, N. Y. (B 863)

Alloy Castings

Corrosion-resistant and stainless steel castings are the subject of a new booklet. Michiana Products Corp., Michigan City, Ind. (B 864)

Multi-Rotary Table

The Wheelabrator multi-rotary table—the airless abrasive method of cleaning fragile or intricate metal parts—is described in Folder No. 33. The American Foundry Equipment Co., Mishawaka, Ind. (B 865)

Chain and Belt Conveyors

Bulletin 1-B discusses conveyors for use at high temperature. Michigan Steel Casting Co., Detroit, Mich. (B 866)

Silico-Manganese Spring Steel

Extreme care is taken in processing this steel to avoid imperfections, according to the manufacturer. Illustrated. Bethlehem Steel, Bethlehem, Pa. (B 867)

Heavy Duty Refractories

This handbook contains complete descriptions, applications, tables and illustrations of standard shapes. Norton Company, Worcester, Mass. (B 868)

Beryllium Copper

Data on properties, heat treatment and fabrication of this copper alloy are given in an illustrated leaflet of The Beryllium Corp. of Penn., Reading, Pa. (B 869)

Air Setting Bond for Firebrick

Wal-Set, for bonding firebrick and other refractory materials, is the subject of an illustrated pamphlet. Wahl Refractory Products Co., Fremont, O. (B 870)

Lithoform

This non-inflammable liquid makes paint stick to galvanized iron and other metals that shed paint. American Chemical Paint Co., Ambler, Pa. (B 871)

Low Voltage Generators

Advanced features of design permitting light weight, compact size, more efficient performance and continuous operation are claimed for these generators. Columbia Electric Mfg. Co., Cleveland, O. (B 872)

MANUFACTURERS' LITERATURE

Heat and Acid Resisting Castings

Bulletin No. 21 lists the most popular analyses of Standard-Alloy together with safe workable loads at different temperatures. The Standard Alloy Co., Cleveland, O. (B 873)

Temperature Control

An all electric automatic control which operates on the radio principle is described in an illustrated leaflet. Wheelco Instruments Co., Chicago, Ill. (B 874)

Titanite Quartz

Characteristics and value of Sharon conglomerate are discussed. The Portsmouth Refractories Co., Portsmouth, O. (B 875)

High Frequency Electric Power Converters

High frequency electric converters for use in conjunction with numerous industrial induction heating applications are described. Lepel High Frequency Laboratories, Inc., New York, N. Y. (B 876)

Aerocase

Booklet on this subject. Illustrations, curve charts, tables. American Cyanamid and Chemical Corp., New York, N. Y. (B 877)

The Brackelsberg Furnace

Bulletin No. 197 shows how this furnace lowers the cost of quality castings; other important advantages and design and operation are discussed. Whiting Corp., Harvey, Ill. (B 878)

Air Conditioning Lectrodryer

This equipment is designed for dehumidification and not for temperature control. Pittsburgh Lectrodryer Corp., Pittsburgh, Pa. (B 879)

Electromet Review

This publication, whose purpose is to bring "News and Views of Alloy Steels and Irons" to the reader, contains interesting items. Electro Metallurgical Co., New York, N. Y. (B 880)

Research Microscopes

Microscopes and their accessories are discussed in Catalog M66. Spencer Lens Co., Buffalo, N. Y. (B 881)

Control of Furnace Atmosphere

Two bulletins devoted to a description of "Certain Curtain Control of Atmosphere"; and to furnaces for pre-heating and hardening high-speed steel have been issued by C. I. Hayes, Inc., Providence, R. I. (B 882)

Improved Pot Hardening Furnaces

A leaflet devoted to these furnaces has been issued by the American Gas Furnace Co., Elizabeth, N. J. (B 883)

Carbon Determinator

Construction and operation of the Leco Carbon Determinator are explained in an illustrated booklet. Laboratory Equipment Corp., St. Joseph, Mich. (B 884)

Alloy Steels

A colorful folder devoted to these steels lists some of the advantages to be obtained by their use. Bliss & Laughlin, Inc., Harvey, Ill. (B 885)

Speed Case Steels

Data on the three new types of this company's "Speed Case" steel in the higher carbon ranges are offered by The Monarch Steel Co., Indianapolis, Ind. (B 886)

Superficial Hardness Tester

Catalog Supplement RS-3 is devoted to this hardness tester, intended for tests where only very shallow penetration is possible. Wilson Mechanical Instrument Co., New York, N. Y. (B 887)

Optical Pyrometer

The Burrell optical pyrometer, a direct reading instrument, is described in a leaflet published by the Burrell Technical Supply Co., Pittsburgh, Pa. (B 888)

Vapor-Spray-Vapor Detrex Degreaser

This special machine equipped with a monorail conveyor is described in literature from the Detroit Rex Products Co., Detroit, Mich. (B 889)

Stainless Steel Castings

An attractive booklet contains useful information on the subject. Typical analyses, characteristics and suggested uses are listed. Joseph T. Ryerson & Son, Inc., Chicago, Ill. (B 890)

Ring Type Proving Instruments

These instruments for checking testing machines are made in eleven capacities—compression only and compression and tension both. Morehouse Machine Co., York, Pa. (B 891)

Armco H.T.-50

An illustrated folder on the above alloy steel contains data on physical properties, corrosion resistance and forming and welding qualities. American Rolling Mill Co., Middletown, O. (B 892)

Turbo-Compressor Data Book

This Data Book No. 107 gives accurate information on the characteristics of turbo blowers and exhausters. The Spencer Turbine Co., Hartford, Conn. (B 893)

Konik

Data on this steel's physical properties, corrosion resistance and working are offered by the Continental Steel Corp., Kokomo, Ind. (B 894)

Quenching Machine

In the Greene tank objects are forced apart and kept in motion, solution vigorously sweeps over the objects and cooling is equal on all sides according to a leaflet of E. G. Greene, Cleveland, O. (B 895)

Modern Metal Finishing

This bulletin, issued periodically, conducts a Questions and Answers department for metal treaters. E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. (B 896)

3300 Deg. Super Refractory

An illustrated catalog devoted to "Shamva" Mullite contains information regarding its background, characteristics and uses. Mullite Refractories Co., Shelton, Conn. (B 897)

Lead

New methods for making lead pipe and lead sheet are announced by The Andrews Lead Co., Inc., Long Island City, N. Y. (B 898)

Hi-Steel

Information concerning chemical composition, physical properties and corrosion resistance of this steel is offered by the Inland Steel Company, Chicago, Ill. (B 899)

Dowmetal Data Book

A new edition, containing especially significant accomplishments in the sections Available Forms and Shop Practice has been published by The Dow Chemical Co., Midland, Mich. (B 900)

Steel Castings

A number of the more popular carbon, alloy and stainless steels made by this company are discussed in a leaflet. Lebanon Steel Foundry, Lebanon, Pa. (B 901)

Monel Metal

Many of the industrial uses of this alloy are discussed in a catalog entitled "Strength Plus—Monel for Mechanical Jobs." The International Nickel Co., Inc., New York, N. Y. (B 902)

Fire Brick

This company's Empire fire brick is the subject of a booklet in which the three types—dry press, stiff mud and hand-made—are described. A. P. Green Fire Brick Co., Mexico, Mo. (B 903)

Gas Analysis

Bulletin describing the thermal conductivity method of gas analysis is published by Charles Engelhard, Inc., Newark, N. J. (B 904)

High Temperature Insulation

For all types of heated equipment is the subject of an illustrated leaflet issued by Armstrong Cork Products Co., Lancaster, Pa. (B 905)

Duraloy

Chrome-nickel and chrome-iron alloy groups with recommended applications are listed in a pamphlet from Duraloy Company, Pittsburgh, Pa. (B 906)

The Metal Analyst

Equipment for metallurgical laboratories is described and illustrated in a booklet of Adolph I. Buehler, Chicago, Ill. (B 907)

Controlled Grain Anodes

Seymour Nickel Anodes are homogeneous in grain structure, according to this bulletin. Available shapes are illustrated and useful data are given. The Seymour Manufacturing Co., Seymour, Conn. (B 908)

Metal Working Products

A pamphlet containing information on this company's rust preventives, cutting oils, metal cleaners, liquid baths, quenching oils, etc., has been issued by E. F. Houghton & Co., Philadelphia, Pa. (B 909)

Gas Fired Furnace

The gas fired Lindberg Cyclone furnace for temperatures from 250 deg. F. to 1400 deg. F. is claimed to heat remarkably fast. Lindberg Engineering Co., Chicago, Ill. (B 910)

Drop Forging Topics

Interesting articles are included in this illustrated publication of the Drop Forging Association, Cleveland, O. (B 911)

Special Atmosphere in the Heat Treatment and Brazing of Metals

A reprint of the above article by C. L. West, Research Engineer, is offered by The Electric Furnace Co., Salem, O. (B 912)

Free Cutting Steel

An attractive booklet records fifteen years research on the machinability of free cutting steels. Jones & Laughlin Steel Corp., Pittsburgh, Pa. (B 913)

Current News Items

American Welding Society Appoints Warner S. Hays Managing Director

A. E. Gibson, preesident, the American Welding Society, 33 West 39th St., New York, announces the appointment of Warner S. Hays as managing director. Mr. Hays brings to the society an unusual combination of experience and background in engineering, sales, publishing, membership development and association management. He is a past president of the American Trade Association Executives, a member of the Philadelphia Rotary Club, The Yale Club of New York and is on the executive committee of the Yale Engineering Association. He is also a former officer of the National Industrial Advertisers.

Mr. Hays was born in Cleveland and was graduated from Yale Sheffield Scientific School, where he specialized in electrical engineering. Following his graduation he went to work for the General Electric Co. at Schenectady and Pittsfield, spending several years in the testing and engineering departments and acquiring practical experience in the operation of power stations. Leaving the General Electric Co., Mr. Hays became purchasing agent and assistant general manager of the Interurban and Traction Lines of Rockford, Ill., and later of the Light, Power and Traction lines of DeKalb and Sycamore, Ill.

Following his experience in the public utility field, Mr. Hays became circulation and field manager of McGraw Publishing Co. in New York. Following this experience in the publishing field, he was preparing for managership of a foreign sales office with the Vacuum Oil Company, but the world war interrupted, and he became an officer in the construction division of the United States Army.

Since the war, Mr. Hays has maintained his own consulting, engineering and association executive office in Philadelphia. He has served many individual firms, the government, and industries on personal relations, reorganizations, association management, advertising and merchandising surveys and has conducted campaigns for technical or engineering as well as trade associations.

A. F. A.'s Annual Convention

The forty-first annual convention of the American Foundrymen's Association, May 3 to 7, in Milwaukee, established new records for accomplishment. The total attendance recorded by registrations and by special admission tickets given to key men identified with the metal working industry in Milwaukee was 7987. While not a record in point of attendance, it is interesting to observe that of those registered, totaling 5040, 4379 were from points throughout the country outside the Milwaukee area.

The sessions at the convention for the discussion of papers and committee reports were outstanding in the history of the Association. The attendance at 20 meetings was exceptional, ranging from 100 to 400 at each meeting.

The group of management sessions, the first complete series ever attempted at an A.F.A. convention, were of unusual interest, presenting outstanding speakers on safety, apprentice and foreman training, occupational disease laws, foundry costs and job evaluation. Of the strictly technical subjects, sand control was discussed from the standpoint of all types of foundries—steel, malleable, non-ferrous and gray iron.

The Refractories Session, with special emphasis on insulating refractories, competed in interest with metal sessions, of which those on gray iron were of unusual value, with some 14 outstanding papers. Of these contributions, two were exceptionally valuable and thorough reviews of their subjects. The steel, malleable and non-ferrous papers also indicated the great interest being devoted to shop, metallurgical and engineering developments in these branches of the industry. The shop operation course sessions maintained their high standards, and again proved that this type of meeting has a distinct place on the program.

The exhibition occupied the main Arena, the Mechanics Hall in the lower level, Juneau, Kilbourn and Walker Halls and the stage, occupying every available portion of the splendid display facilities of the Milwaukee Auditorium. Exhibitors, 220 in all, a record since 1930, showed a complete variety of machinery, equipment, supplies and materials, evidencing a tremendous buying interest. New equipment and products, in many cases, were shown for the first time. Many exhibitors sold all of their products that were exhibited and booked repeat orders, evidencing the interest of the industry in improvement of foundry plant and product.

N.E.M.A. Welding Section to Assist A.W.S. Expansion Program

Recognizing the important functions of the American Welding Society as a technical spokesman for the welding industry, the electric welding section of the National Electrical Manufacturers' Association, at its January, 1937, meeting, voted to furnish financial support for the expansion program which the A.W.S. recently proposed. A matter of immedate importance is the coordination of tests of men, machines and filler metal, so as to relieve some of the unnecessary burden which a great duplication of test requirements has brought about. It is also very desirable to increase the membership of the society, and especially to secure members from a larger number of industrial companies.

A. E. Gibson, after an enviable record as head of the Cleveland Section, accepted the presidency of the A.W.S. with the understanding that he wished to enlarge both its membership and its activities. The society is not equipped financially to carry out some of these desirable projects from current income, but the N.E.M.A. welding section has expressed its confidence in the future of the society and in Mr. Gibson's leadership, by this recent action. They will underwrite the new A.W.S. program to the extent of $10,000. At the March meeting of the N.E.M.A. welding section a coordinating committee was appointed to work with the management committee of the A.W.S. and to make this fund available as it is required for support of the new activities.

Electrochemists Elect New Officers

At the annual meeting of the Electrochemical Society held at Philadelphia the following new officers of the Electrochemical Society were elected:

President: William G. Harvey, Aluminum Co. of America, Cleveland.
Vice-Presidents: L. D. Vorce, New York City; R. L. Baldwin, Niagara Falls, N. Y.; O. W. Storey, Chicago.
Managers: W. W. Winship, New York City; E. M. Baker, Ann Arbor, Mich.; S. Swann, Jr., Urbana, Ill.
Treasurer: Robert M. Burns, 463 West St., New York City.
Secretary: Colin G. Fink, Columbia University, New York City.

Steel Show in Chicago in September

Over 100 manufacturers of steel mill equipment have made their reservations for exhibiting in the Iron and Steel Exposition which is sponsored by the Association of Iron and Steel Engineers and to be held in the Stevens Hotel, Chicago, Sept. 28, 29, 30 and Oct. 1. With 3½ months still remaining before the opening of this exposition, it is expected that approximately another 35 or 40 firms will be represented in this show.

FUEL *Balances* LOAD

UNDER MICROMAX ELECTRIC CONTROL

Here is Temperature Control that can be fitted to any industrial furnace — practically any heat-using process. It not only throttles fuel continuously and proportionately, but can be adjusted so that the normal fuel supply exactly balances any load's average demand. The amount of throttling per degree of temperature can then be adjusted to balance out slight departures from average. Closeness of control is limited only by such factors as rapidity and extent of load change, method of charging furnace, etc. Micromax Electric Control preserves closest possible balance between fuel and load — maintains uniform temperature and uniform quality of product. J-N-A(1)

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Battelle Research Associates

Four appointments as research associates will be available at Battelle Memorial Institute, Columbus, Ohio, for the year 1937-1938. Appointments are for September to August inclusive. These appointments are open to graduates of any accredited university or college. Preference will be given to men who have completed one or more years of graduate study in chemistry, physics, metallurgy, fuel technology or ceramics; or who have demonstrated marked aptitude for scientific research in their industrial experience.

The research associates will be members of a new division of the Institute which will supplement the regular technical staff. The purpose of the research associate division is to extend the work of the Institute in fundamental science and at the same time to develop highly trained research men for industry.

Appointments as Research Associate will be for one year's duration, including vacation, and may be extended for a second year. The salary will be from $1200 to $1800 a year, depending upon the training and experience of the individual. Research associates will be expected to devote their entire time to a research project approved by the director and supervised by members of the Institute staff. Research projects will be of a fundamental or general character looking toward the publication of information that will be useful to science and industry.

Battelle Memorial Institute was established under the will of Gordon Battelle to contribute to industrial progress through scientific research. The activities of the Institute are carried on under nine main divisions: Applied chemistry, industrial physics, process metallurgy, physical metallurgy, ceramics, refractories, fuel technology, ore dressing, and coal washing. Each division is equipped and staffed to carry on research under the direction of a specialist who is qualified by training and experience to direct original research in his field.

Acheme VIII, the German Chemical Engineering Exposition

The Deutsche Gesellschaft für chemisches Apparatewesen E. V. (Dechema) has issued the prospectus for "Achema VIII," the mammoth chemical engineering show to be held at Frankfort-on-Main, July 2 to 11, 1937. The exhibition is being held this year on the occasion of the National Congress of German Chemists, the 50th general meeting of the Verein Deutscher Chemiker, the German Technological Conference, and meetings of other German technical associations. The previous exhibition (Achema VII), held at Cologne in 1934, attracted 50,000 visitors from all over the world and included 367 exhibitors; the total value of equipment displayed was estimated as in excess of one million dollars. The sponsors of Achema VIII expect it to exceed in volume and importance even its unusually successful predecessor.

Research Foundation Formed at Ohio State

Organization of the new Ohio State University Research Foundation has been completed with the election of officers and directors. The foundation was incorporated last November to bring about a closer cooperation between the university and industry, particularly in making the university's laboratory and research facilities of greater helpfulness in solving the problems of industry.

Officers elected to launch the new enterprise are: George W. Rightmire, president; Carl E. Steeb, treasurer; Hurlbut S. Jacoby, secretary and director. All officers are on the university staff, Dr. Rightmire being president, Mr. Steeb business manager, and Mr. Jacoby director of industrial research.

Directors are: Charles E. MacQuigg, New York City; Thomas Midgely, Jr., Detroit; Charles F. Kettering, Detroit; J. L. Morrill, Columbus; Harry A. Toulmin, Jr., Dayton; Arno C. Fieldner, Washington, D. C.; Charles F. Michael, Bucyrus; E. E. Ware, Cleveland; James F. Lincoln, Cleveland; Harry A. Caton, Coshocton; and these from Columbus: Julius F. Stone, Mr. Rightmire, W. W. Charters, John F. Cunningham, and William McPherson.

● The 1937 Metal Mining Convention and Exposition will be held at Salt Lake City, Utah, Sept. 6 to 10, under the auspices of our Western Division, of which Oscar N. Friendly, vice president, Park-Utah Consolidated Mines Co., is chairman.

First Paper in Lincoln Foundation Competition

Robert S. Hale, 1008 Atlas Bank Building, Cincinnati, has the distinction of submitting the first paper in competition for the $200,000 awards of The James F. Lincoln Arc Welding Foundation, according to A. F. Davis, Foundation secretary, Cleveland. Mr. Hale is an architect and structural engineer and holds the position of construction engineer, procurement division, Public Buildings Branch, United States Treasury Department.

Although the actual contents of Mr. Hale's paper will not be known until the paper is delivered to the jury of awards, June 1, 1938, with all other competing papers, the subject of the paper relates to the construction field in which the use of electric welding has made marked progress in recent years. This is evidenced by use of the process on such large construction projects as Boulder Dam, Fort Peck Dam, Oakland Bay Bridge in San Francisco, many large buildings, as well as schools and steel framed houses.

Carboloy Film Shows Rapid Grinding Method

Supplementing their grinding demonstrations of 1936, the Carboloy Co., of Detroit, recently released a sound slide film showing their new, rapid technique for grinding Carboloy tools. It is reported that up to May 1, over 2,000 people, representing 170 firms, have seen this film.

The 124 pictures in the film dramatically present the correct and incorrect methods of grinding Carboloy tools and the proper equipment for correct grinding. Not only does this film describe technical details of interest to tool grinding operators but also, due to the broad benefits and economies which are clearly shown, it is of especial interest to production and administrative executives as well.

After the completion of its western schedule of showings, the Carboloy Co. will make the film available to engineering societies, foremen's clubs, purchasing agents' associations, as well as additional plants interested in obtaining the benefits of this new rapid grinding technique. Requests for this sound slide film may be addressed to Carboloy Co., Inc., 2985 East Jefferson Ave., Detroit.

"Engineering Horse Sense"

Tests to measure "engineering horse-sense" in incoming students have been adopted by the Cooper Union Engineering Schools, New York City, it is announced by Dean George F. Bateman. The tests will be included experimentally in the aptitude examination to be taken in the fall by more than 2,000 applicants, less than one-seventh of whom can be admitted, owing to physical limitations of the schools, Dean Bateman said.

While the "horse-sense" tests will have no bearing on the success or failure of the candidates this year, the results will be used as a guide for devising future quizzes taking into account inherent fitness for the engineering profession as well as intellectual aptitude, it was explained. Admission to Cooper Union is based solely on the aptitude tests, which are competitive. The school has been one of the pioneers in developing this method of examining applicants, which was adopted in part by the College Entrance Examination Board.

● Following a two-year experimental period with insulating fire brick for incinerators, the City of New York has specified 2600-deg. insulating fire brick in combustion chambers and flues because of the reduction of slagging to a minimum. An installation was made 2 yrs. ago of "Armstrong's EF-26" brick, Armstrong Cork Co., Lancaster, Pa., in a combustion chamber in one of New York City's incinerators. The brick was used directly exposed in an area 16 ft. by 12 ft. and 9 in. thick. The bricks were laid and faced with air set cement and the results of the installation have been highly satisfactory. The brick has been found to be in excellent condition and newspaper ash has never slagged on the wall because of the low heat storage content of the brick. A $\frac{3}{8}$-in. crust was the only deposit on the wall after the incinerator had been in operation several months and this crust was easily removed. On the opposite wall, built of fire brick, fly ash built up to a 2-ft. thickness of hard slag every 2 weeks. The slag was not only difficult to remove but the chiseling required to remove the slag caused the disintegration of the brick work and it was necessary to install new walls every 3 or 4 mos.

Personals

F. M. Becket Honored By Electrochemists

The Electrochemical Society awarded at its Spring meeting the Acheson Medal and $1000 Prize to Dr. Frederick Mark Becket, president of Union Carbide & Carbon Research Laboratories, Inc., and vice-president of the Electro Metallurgical Co. and the Union Carbide Co., for his outstanding contributions to electrometallurgy. The highly developed alloy steel industry of today, with its stainless alloys, its high-speed tools, and high temperature resistant products used in the electrical industry, owes much of its rapid spread to Becket's inventions.

Three Foundrymen Awarded Medals

In accordance with the recommendation of the board of awards of the American Foundrymen's Association, three medals recognizing achievement and service to the foundry industry were presented at the annual dinner, Thursday, May 6, during the annual convention and exhibition in Milwaukee. The awards and their recipients are as follows:

The John A. Penton Medal to John Ward Bolton, Lunkenheimer Co., Cincinnati.

The J. H. Whiting Medal to Dr. James T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala.

The William H. McFadden Medal to Charles Willers Briggs, U. S. Naval Research Laboratory, Anacostia Station, Washington, D. C.

● C. E. Sims who is connected with Battelle Memorial Institute, Columbus, Ohio, as research metallurgist, has been elected a director of the American Foundryman's Association. Mr. Sims has been active in the steel castings industry for a number of years and has published a number of papers dealing with the technical problems of the industry.

● Gilbert E. Doan, associate professor of metallurgy at Lehigh University, has just been advanced by the board of trustees to the position of professor of metallurgy.

● E. E. Wright has been appointed to take charge of the Cleveland office of Electro Metallurgical Sales Corp. Mr. Wright is a graduate of Lehigh University, having received the degree of Engineer of Mines in 1912. From 1918 until his present appointment, he has been with both the works and the sales departments of National Carbon Co., Inc. Electro Metallurgical Sales Corp. and National Carbon Co., Inc., are units of Union Carbide & Carbon Corp., New York.

● Walter S. Aylesworth, Martin Building, Pittsburgh, formerly Western Pennsylvania District Representative for Chas. Taylor Sons Co., is now representing The Mullite Refractories Co. in the Pittsburgh district in the sale of the "Shamva" Mullite super refractory products. The Mullite Refractories is a pioneer in the manufacture of Mullite refractories, using Indian sillimanite as a raw material. A complete modern research and testing laboratory and factory is maintained at Shelton, Conn.

● The Electrochemical Society has awarded the ninth Weston Fellowship of $1000.00 to Garth L. Putnam, of Seattle, Wash. Mr. Putnam will continue his research at Columbia University, investigating methods of efficiently depositing alloys of active metals from aqueous solutions. The work will be done under the direction of Prof. Colin G. Fink. The Fellowship was founded by Dr. Edward Weston, a foremost pioneer in electrochemistry.

● Martin Rieger, Jr., has recently joined the New York office of the Foxboro Co., Foxboro, Mass., as a specialist in the pyrometer division of that company. Mr. Rieger is an electrical instrument engineer formerly connected with the Weston Electrical Instrument Corp.

● The Electrochemical Society, at its annual spring convention in Philadelphia, awarded to William A. Johnson, of Pittsburgh, the Society's Prize to Young Authors, for the paper published jointly by Mr. Johnson and Prof. Allison Butts entitled, "Studies of Overvoltage: The Effect of Fusion of the Cathode and the Effect of Temperature on Gas Polarization." Mr. Johnson at present holds the Molybdenum Co.'s Fellowship in Metallurgy at the Carnegie Institute of Technology, where he is investigating the heat treatment characteristics of tungsten steels.

● At a meeting of Council of the British Non-Ferrous Metals Research Association held in April, Lt.-Col. J. H. M. Greenly, C.B.E., M.I.E.I., M.A., was elected chairman in succession to the late Thomas Bolton. Col. Greenly, deputy chairman of Messrs. Babcock & Wilcox, Ltd., has been closely connected with the non-ferrous metals industry since 1920 and with the Research Association since 1925 and has served as a member of Council almost continuously throughout the latter period.

● Floyd M. Erlenmeyer has been appointed Western New York representative for Maas & Waldstein Co., Newark, N. J., makers of industrial finishes.

● J. R. Heckman, for the past 5 yrs. district sales manager of the Chicago District of The Midvale Co., has resigned to become district manager of the General Alloys Co., in the same territory. J. C. Glass, who has been associated with The Midvale Co. for the past 17 yrs. in the Cleveland District will succeed Mr. Heckman.

● Joseph J. Sweeney, 737 South Frazier St., Philadelphia, formerly connected in a sales capacity with Botfield Refractories Co., has taken over the eastern territory as sales representative for the Thermal Products Corp., Pittsburgh.

● Hayward Niedringhaus, president of the Granite City Steel Co., Robert W. Wolcott, president of the Lukens Steel Co., and C. F. Stone, president of the Atlantic Steel Co., have been elected directors of the American Iron and Steel Institute. Directors whose terms expired have been reelected for 3 yrs.

● A. J. McDonald, heretofore eastern district sales manager in charge of the Philadelphia office of the Lebanon Steel Foundry, Lebanon, Pa., has been elected vice-president in charge of sales. K. V. Wheeler has been made vice-president and plant manager and Fred Grotts, vice-president and metallurgical director.

● Lewis B. Lindemuth, consulting engineer, New York, now in Australia for the Broken Hill Proprietary Co., Ltd., is expected to return to New York in June. He then plans to go to England to continue his work with Richard Thomas & Co. Ltd.

● At a meeting of the board of directors of General Refractories Co., held recently, S. M. D. Clapper, formerly president, was elected chairman of the board, and Floyd L. Greene, formerly executive vice president, was elected president.

● The associates of Frank H. Adams, vice president and general manager of the Surface Combustion Corp., Toledo, Ohio, honored him with a dinner at the Toledo Club recently, celebrating his twenty-fifth anniversary with the Henry L. Doherty organization.

● The Defiance Pressed Steel Co., with factory at Marion, Ohio, and sale, research and experimental offices at Toledo, Ohio, announces the appointment of W. Herbert Bretzlaff as vice president.

● Carl E. Sprout has been appointed an associate of B. W. Sayer, district manager of the Portland, Oregon, office of the Foxboro Co. Mr. Sprout comes here to assist in handling the increased volume of business in this territory from the San Francisco office of the Foxboro company.

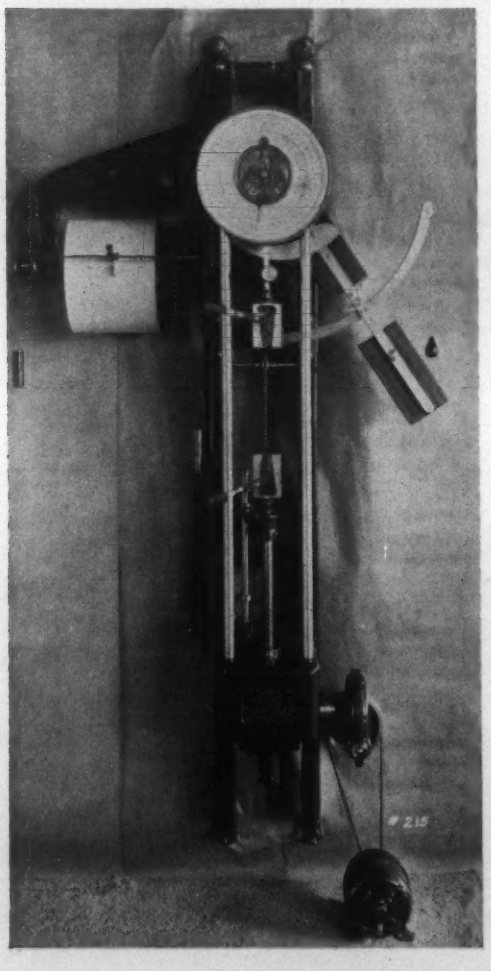
● The Chicago Chapter of the American Society for Metals has elected new officers for 1937-1938 as follows: Chairman, E. Grammiter, metallurgical engineer, Carnegie-Illinois Steel Corp.; vice-chairman, W. E. Remmers, metallurgical engineer, Electro Metallurgical Sales Corp.; secretary-treasurer, K. H. Hobbie, district sales manager, Driver-Harris Co.; assistant secretary, E. A. Terwell, sales engineer, Driver-Harris Co.

New Equipment and Materials

A Wire Testing Machine

An improved type of wire testing machine with a recorder arranged so as to greatly magnify the test line in the stretch direction is a product of the Henry L. Scott Co., Providence, R. I.

The machine is of the vertical inclination balance type with the capacities of 0-250 and 0-500 lbs., thus having a light and sensitive machine for the small sizes and still retaining the machine of higher capacity and the same accuracy for tests on the larger wires. The clamps, as the illustration shows, are of the wedge type, as used on the company's other machines, and the lower one is mounted solidly on the top of 1⅛ in. dia. draw bar. The drive is through



a train of gears and the reduction ratio is such that a ¼ hp. motor is all that is required to operate the machine to its full capacity.

The construction is made extremely rigid in order that the graph line shall represent truly the action of the specimen under strain, and eliminate from the record all question of machine deflection, etc.

This machine is furnished with 2 gear ratios in the drive to the recorder cylinder and magnifies the line either in the proportions of 10 to 1 or of 20 to 1. In the load direction the pen is drawn from left to right by means of a small chain attached to the grooved segment carried by the weight arm. The standard machines are arranged with an initial distance of 10 in. between the clamps and this can be varied so that greater or less length of wire can be taken as a test specimen. The accuracy of less than 0.25 per cent is possible on routine testing without a specially trained operator.

The charts can be of the conventional ruled form to suit the machine which allows the test line to be immediately compared with the base line and the yield points easily figured in the load vs. elongations determined. Plain paper can also be used and the figuring done by the assistance of special drawing and measuring apparatus furnished for the purpose by us. This is a very simple way of figuring that can be carried out by any one and reliable and dependable results obtained.

One of the chief features of the entire apparatus is that it can be operated by any person of average intelligence and correct results obtained. So carefully is the machine constructed that, with a non-extensible bar in place between the upper and lower clamps, a straight line is generated on the recorder thus proving that any deflection of the test line from the straight represents characteristics in the material under tension.

As a machine for routine work it is simple of operation, rugged in construction and reasonably fool proof. The high degree of accuracy makes it well suited to laboratory investigations and research.

It is designed for wall mounting and occupies a wall space of approximately 36 in. in width and the center of the dial is approximately 75 in. from the floor. The case dimensions are: 92 in. long by 24 in. high by 40 in. wide. Its net weight is 529 lbs., and the shipping weight is 697 lbs.

Gas Producer for Producing Clean Gas

The Wellman Engineering Co., Cleveland, announces that it has acquired the exclusive right and license under the United States patents of Albert L. Galusha to manufacture and sell within and throughout the United States and its possessions the Galusha Gas Generator which produces a clean, high-grade, industrial gas from small anthracite coal, or coke-breeze, at a cost considerably below figures hitherto regarded as the minimum.

This generator provides a uniformly clean, and dependable gaseous fuel, since the fuels used do not yield tar, and is therefore particularly adapted to industrial heating operations in which the quality of the product requires care to avoid discoloration, scaling, pitting or spotting.

This Gas Generator will be marketed as the "Wellman-Galusha Clean Gas Generator" in standard units with hearth diameters from 18 in. to 10 ft., the capacity of each unit being unusually high, varying of course with the grade and character of the fuel used.

Albert L. Galusha, the inventor, has become associated with the Wellman Engineering Co. as chief engineer of the "Wellman-Galusha Gas Equipment", and is located at the company's eastern offices at 30 Church St., New York City.

The addition of the Galusha Clean Gas Generator for utilizing anthracite, and coke breeze fuel, to the well-known line of "Wellman Mechanical Gas Producers" which use bituminous coals as fuel, puts the Wellman company in the position of being able to supply either clean gas generators or hot raw gas producers, for the various industries where gaseous fuels are suitable.

Amsler-Morton Soaking Pit

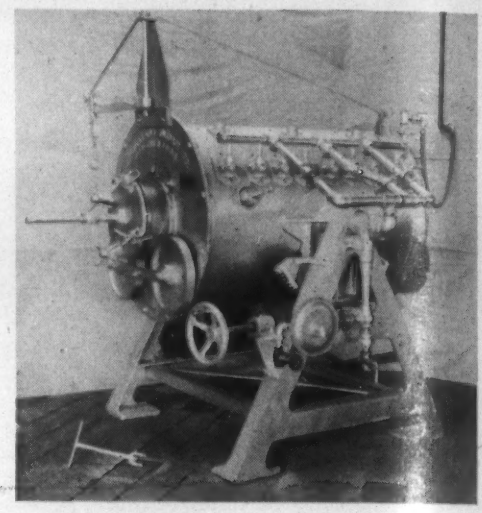
A new type of soaking pit, produced by the Amsler-Morton Co., Pittsburgh, has been introduced in the plant of a large Pittsburgh steel company. It is claimed to possess a number of advantages—simplicity, adaptability to any type of fuel, low fuel consumption by means of recirculatory gas flow, recuperator design, automatic firing, and a highly efficient cover. It is called the "AMCO" soaking pit.

A complete, detailed and illustrated description of this new unit, by H. F. Spencer and C. F. Harington, was published in The Iron Age, Dec. 3, 1936, pp. 47-51 and 130.

Improved Rotary Gas Carburizing Machine

The American Gas Furnace Co., Elizabeth, N. J., announces numerous improvements in its widely used 600-lb. capacity Rotary Carburizer, which is now known as the No. 2-B'37. This machine is now supplied with an improved lining consisting of insulating refractory backed by block insulation which gives much lower gas consumption than formerly.

The burners are of heat-resisting alloy and fire into special high temperature refractory burner tunnels, thus insuring long life with freedom from repairs. The burners with their tunnels are easily removable for inspection and



repairs when they become necessary. They fire from one side of the machine only, thus reducing maintenance and inspection charges and, more important, giving a flame which sweeps entirely around the retort with uniform heating at all points.

The burners are graduated in size to insure uniform heating throughout the entire retort length, despite the greater radiation losses at the ends. They are served by a single valve control set using air at 1 lb. per sq. in. and gas at 4 to 6 in. water column. This machine is also supplied for high pressure gas where so desired.

A simple and efficient crane is supplied for handling the cover. The cover itself is of improved design with insulation extending from the outer cover to the inner heat-resisting alloy spacing disc.

Cement for Polishing Wheels

A new cement for polishing wheels is announced by Midwest Abrasive Co., Detroit, according to James T. Jackson, president. It is intended to replace glue and is offered as a simplified method of preparation, requiring no heat. By the use of a special thinner, any density of cement required can be made up so that wheels of varying densities can be uniformly surfaced. This feature permits exact regulation for wheels of canvas, leather, felt, sheepskin, wood covered with leather, compressed leather or felt.

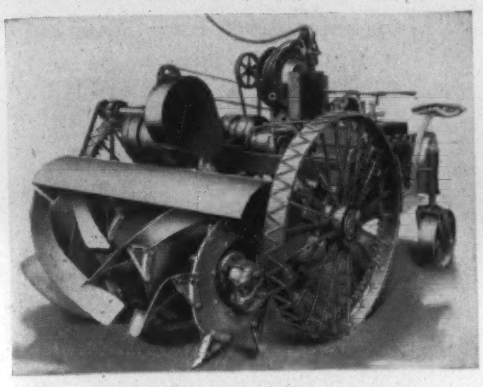
The Midwest Abrasive Co., manufacturers of abrasives, including sandpapers, emery cloth and grinding wheels, developed the new cement after thorough scientific study of the problems involved in the correct surfacing of polishing wheels. The company announces that many large users of polishing wheel cements in the Detroit area are using it with marked success.

The policy of the company is to send generous sized samples of the product to those interested in its use. Readers of this journal are invited to take advantage of this offer.

The Model "M" Sand Cutter

A new model sand cutter is announced by The American Foundry Equipment Co., 555 South Byrkit St., Mishawaka, Ind. This Type "M" Sand Cutter was designed primarily to fill a long-felt need for heavy duty, portable sand conditioning equipment on crowded foundry floors.

The cutting action imparted to the sand by a new lawnmower type of cutting cylinder comprises a thorough slicing, beating, tossing into the air and crossing the sand from one side of the heap to the other. The sand falls into a ridged windrow formation, loose, cool, and ready for molding. By driving the sand cutter



backward and forward over the windrow a few times, the sand is piled into a heap beside the bench or molding machine.

Overall width of this machine is only 19 in. greater than the length of the cutting cylinder, permitting easy manipulation in crowded quarters. The framework is ruggedly built of heavy, bolted steel. "Knee action" is obtained through the use of an equalizer which permits the steering casters to raise or lower on uneven foundry floors, without affecting the balance of the machine.

Sand conditioning is accelerated in the "M" Sand Cutter due to the high axle clearance which reduces sand drag on the undercarriage to a minimum. An automatic take-up reel which keeps the electric cable taut at all times is located at the center of gravity on the machine, making steering smooth and easy. All ball bearings are sealed, many of them being immersed in oil. Special non-clogging treads are used on the drive wheels, insuring positive traction regardless of floor conditions.

Four electric motors furnish power for all operations of this equipment. This multi-motor feature eliminates all need for many clutches, transmissions, and other wearing parts; assures a longer motor life, as no single motor is ever under a strain; and guarantees much quieter operation.

The fact that no two men shovel exactly alike is obvious. Even one man's work varies with his moods, fitness and the weather. The Type "M" Sand Cutter eliminates human irregularity in sand conditioning, preparing the sand uniformly day after day.

Precision Valve for Furnace

A precision valve, recently introduced by Mehler, Inc., Commonwealth Trust Building, Pittsburgh, into the general furnace field, is reported to have been in use on open-hearth furnaces by such companies as the U. S. Steel Corp., Ford Motor Co., Youngstown Sheet & Tube Co. and others.

The feature of Mehler valves is fine regulation of fuel flow such as is impossible with needle valves. This is brought about by restriction of the full pipe flow or area by calibration in the valve seat, rotor orifice, or both. The valve works like the pupil of the eye through knife edged orifice and a knife edged closing device, regulated by a handle with a travel of 7 in. over a graduated circular dial, instead of wheel type adjustment with its uncertain regulation. One half of the seat orifice edge and one half of the super imposed rotor orifice edge form the regulating orifice. Where these edges move away from each other (like opening shear blades) dirt or grit drops out of the opening or is sheared off and broken up if the edges move in a closing direction. This feature results in a self-cleaning or non-clogging function so desirable in restricted flow where orifice area is measurable in minute fractions of a square inch.

An outstanding advantage claimed for this type of orifice is that the flow can be increased gradually from a minute opening to full flow, or in terms of gallons or cubic feet. Reversing is said to be accomplished without backlash.

The manufacturer has available interesting data covering the use of the Improved Mehler Precision Valve on all types of furnaces employing fuel oil or gas as the heating medium.

"Speed Case" Steels

Since the introduction of "Speed Case" more than two years ago, the Monarch Steel Co., Indianapolis, Ind., has constantly improved this steel, working always toward the end of obtaining higher physical properties and, at the same time, not sacrificing anything in free machining.

The experimenting necessary to bring Speed Case up to the point where it is today required a great deal of time, and the facts disclosed in these experiments led the company to believe that a steel of the same type could be produced in the higher carbon ranges. The facts listed below will explain how successful the company was in producing a steel with fine physical properties and, at the same time, machinability ratings unheard of for the high carbon ranges.

It is well to keep in mind that Speed Case is the only open-hearth steel with good physical properties, including both strength and ductility, which will machine faster than SAE 1112 Bessemer screw stock. This is most unusual for an open-hearth, case hardening steel, which will machine at over 200 surface ft. per min., yet is ductile enough to take a 1-in. round cold drawn bar and bend it flat on itself, or tie it in a knot and put it tight, without the slightest sign of fracture. For this reason Speed Cast is used on a multitude of jobs where free machining is essential, yet where the ability to stand severe cold forming, crimping, rolling or bending operations is most essential.

The first high carbon steel brought out by the company was our Speed Treat X-1535, 0.30 to 0.40 carbon, which, like Speed Case, is an open-hearth steel using the same exclusive Speed Case process. X-1535 develops considerably more strength due to the high carbon, yet it machines practically as fast as Speed Case and is almost as ductile. This steel has a tensile strength of approximately 95,000 lbs., yet it will machine at over 150 surface ft. per min., or carrying a machinability rating of 100%; it gives very good tool life and is ductile enough to bend flat on itself in cold drawn without fracturing.

The third and most recent steel brought out is "Speed Treat X-1545," which is an 0.40 to 0.50 carbon, open-hearth steel, having a tensile strength of 110,000 lbs. per sq. in., and, like the other two steels, is in a class by itself as far as free machining is concerned. X-1545 approaches SAE 1112 Bessemer in free machining, as it carries a rating of 90%. If this is compared to SAE 1045, which carries a rating of 57%, and it is kept in mind that Speed Treat X-1545 is from 5,000 to 10,000 lbs. stronger in tensile, it will be seen that large savings can be made in machining, which will offset many times the slight increase in the cost of X-1545.

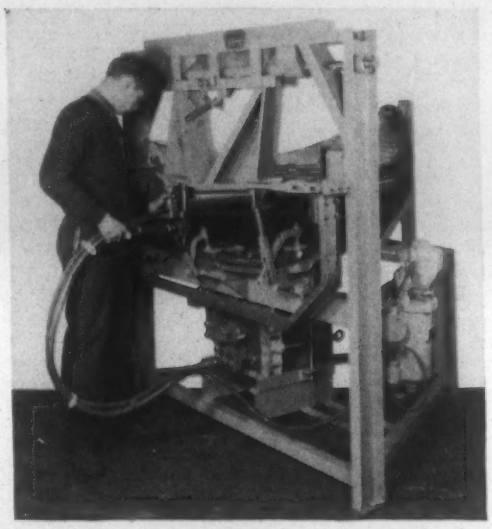
Summing up, it will be noted that Speed Case will machine faster than SAE 1112 Bessemer, X-1535 at the same speed, and X-1545 only slightly lower. This means that, due to the varied and unusual physical properties, these three steels can replace to good advantage practically all of the SAE non-alloy steels under 0.50 carbon. It is merely a question of choosing the steel of the proper tensile strength, as it is no longer necessary to slow up production merely because the steel required happens to be in the high carbon range.

Speed Case, of course, has been recognized for some time as being a leader in the case hardening field, on account of the ability to get a tough and ductile core of approximately 28 Rockwell C, in combination with a hard uniform surface of from 63 to 66 Rockwell C. The two Speed Treat steels, X-1535 and X-1545, lend themselves readily to heat treatment, so excellent physical properties can be developed in the heat treated state, yet at the same time the user has the advantage of machinability far in excess of what was formerly obtained from steels of the same carbon content.

Hydraulic Spot-Welding Gun

The "Progressive Hydraulic Spot-Welding Gun" is pointed to by the Progressive Welder Co., 737 Piquette St., Detroit, as being as advanced in its field as the first automatic welder was over the old foot-operating method. The principle of hydraulic action, the Progressive Company's contribution to spot-welding, offers the following advantages:

Fingertip pressure control giving a smooth, even, adjustable pressure at the welding points; increased wearing qualities and life of parts



because they are self-lubricated; all small delicate parts are removed from the gun handle, giving solid, rugged construction to the gun, the part handled and most likely to be damaged; its inherent characteristics of the hydraulic principle give this new equipment an advantage over any other hand gun in the field, it is claimed.

Some of the other features claimed for this gun are the following: Light weight, compact; ease of handling; water-cooler points, gun, cables, transformer; continuous, perfect welds; just trigger actuation makes complete welding cycle; necessary pressure built up before welding; automatic timing; asbestos insulated transformer; and elimination of human element.

Recording Meter Chart

A newly developed recording meter chart for use in all cases where ordinary paper charts are destroyed after one day's use has been announced by Permochart Co., Koppers Building, Pittsburgh. The new chart is called "Permochart." The smooth, hard-surfaced chart, which can be cleaned by the use of a damp cloth, is made from a recently developed wrinkle-proof, waterproof, non-inflammable material. Actual tests have proven the charts effective for over 2 years. It is said that the use of "Permocharts" have effected direct savings of 75% to 85%, giving the same accurate record as ordinary paper charts. "Permocharts" can be made to fit all types of recording instruments for flow, temperature, pressure and vacuum, humidity, electricity, motion, speed, etc. No change of meter is necessary. No change of pen or ink is required. In fact, it is said that "Permochart" uses less ink than paper charts. A circular is available which describes these charts in detail.

Ni or Ci Steel Round Edge Flat Wire

The American Nickeloid Co., Peru, Ill., announces the putting on the market of nickel steel and chrome steel round edge flat wire. With such wire, it is pointed out, certain products can be "dressed up" without making expensive changes in fundamental design and manufacturing routine. Such low-cost, steel base trim metals give new brilliance, price appeal, and sales appeal to a multitude of fast-selling items. Steel base, round edge flat wire forms spot welds or solders easily. Its brilliant finish cannot be marred or scratched in ordinary production routine. It is available in all standard widths and lengths in either bright or satin finish.

Hydro-Blast for Cleaning Castings

The Hydro-Blast Corp., 111 Washington St., Chicago, has developed an apparatus for cleaning castings which employs a stream of water with which sand is mixed. It is called an improved wet sand cleaning method. A high pressure pump delivers water through a high pressure hose at 25 gal. per min. at a pressure of 1000 lbs. per sq. in. Sand from the blast sand tank is added to the water system at the gun.

This apparatus was represented at the A.F.A. Foundry Show at Milwaukee early in May as in use in several larger American foundries.

Fractional Horsepower Air Compressors

The Ingersoll-Rand Co., Phillipsburg, N. J., has announced a new line of fractional horsepower air compressors. These units are made in ¼ and ½ h.p. sizes. These units are compact and neat in appearance. They have automatic start and stop control, are equipped with with a new style seamless steel tank, and an improved check valve.

When furnished for single phase current they are equipped with a brushless capacitor type motor and a built-in automatic protection switch giving overload and under-voltage protection. They are rated for 150 lbs. per sq. in. maximum pressure, but may be set for lower pressures, or may be equipped with a reducing valve for still lower pressures.

The ¼ and ½ h.p. units are available on a 2.4 cu. ft. tank. This unit is less than 35 in. high. The ½ h.p. size is also available on a 4.6 cu. ft. tank in either vertical or horizontal mounting. If desired the units can be furnished less the tank. The units are furnished in an attractive opalescent brown.

Literature is available on request.

A New Instrument Slide Rule

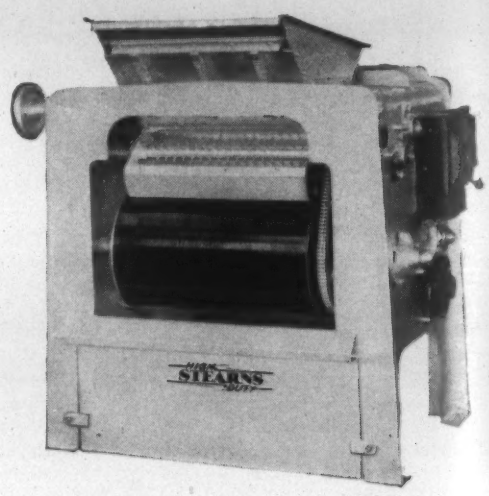
An ingenious slide-rule indicator for use in selecting the proper instruments for any application, whether central stations, industrial plants or transportation industry—has been announced by the Westinghouse Electric & Mfg. Co. Called the "Instrulector", this slide-rule shows at a glance what instruments to use, their range, approximate price, size, descriptive literature available. The Instrulector is available from the nearest district office or direct from the advertising department, 7-N, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Stearns Magnetic Separator

A new modern design for its popular Type "L" magnetic separator is announced by the Stearns Magnetic Mfg. Co., formerly Magnetic Mfg. Co., at Milwaukee, Wis.

Several new features are incorporated in this new model, principal of which is the self-contained complete drive. The motor can be operated from any convenient A.C. source available. The unit is also equipped with generator where D.C. is not available, the motor being sufficiently large to drive both generator and separator.

Operating units are entirely concealed so that all moving parts are thoroughly protected. This provides complete safety for the operator. Anti-friction bearings are used throughout. Transmission is new roller chain type with cut steel sprockets. The adjustable pin-type feed hopper has been lowered into the frame, making it a decided advantage where hand labor is used for feeding material.



By removing the division gate, the Type "L" separator can be transported readily with lift trucks. Special reinforced cross ties support the entire frame.

The Type "L" is being successfully used in the treatment of abrasives, baking powder, bone meal, cocoanut, carbon, shellac, copper scale, dry bone, fertilizer, glass cullet, glass sand, gluten, casein, silica, grain, malt, stock, etc. In addition it has profitable value in separating metal borings and turnings and reclaiming brass, bronze, and aluminum.

An Air Drying Spot Welding Black Primer

The Sherwin-Williams Co., Cleveland, announces an "Air Drying Spot Welding Black Primer" developed primarily for automotive production manufacturers, which has won the complete approval of every manufacturer who has tested it. It should also have a definite appeal to commercial body builders and repaint shops that specialize in metal body repair work, and all manufacturers who use welded construction.

Air Drying Spot Welding Black Primer X9185 solves the problem from rusting of lapped edges to be welded—a difficulty where partially fabricated parts are shipped or stored. It also overcomes the problem of spot welding surfaces that are given coats of ordinary paint, enamel, lacquer or varnish. Such a film tends to insulate the metal surfaces with the result that, when sufficient current is used to weld the painted spots, so much heat is created the metal surrounding the painted area burns and gives a poor weld.

S-W Air Drying Spot Welding Black Primer has the following claimed characteristics:

Reduction 150-200% with VMP Naphtha. Xylol or tuluol can be sprayed on sheet metal parts after.

Dries to touch in 10-15 min., and handled for spot welding in 25-30 mins.

Permits instantaneous spot welding with low voltage and low pressure. Eliminates burning away of paint surrounding the spot weld.

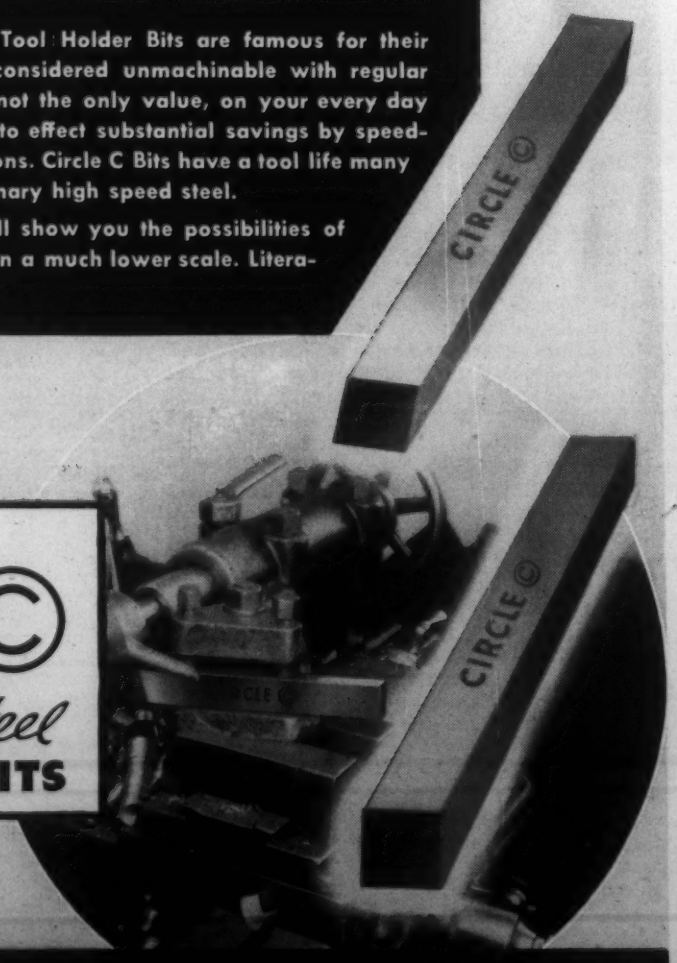
Prevents rust forming between the laps, the place where moisture accumulates and causes most damage to unprotected steel.

DOES *High Speed* *production* GIVE YOU A PROFIT?

In your shop right now perhaps there is a cutting job that you would like to do at a profit—It may be a tough alloy or a heat-treated steel or some other material on which ordinary high speed steels fail, especially at high speeds.

Circle C Super High Speed Tool Holder Bits are famous for their ability to machine materials considered unmachinable with regular high speed steel—But that is not the only value, on your every day production, you can use them to effect substantial savings by speeding up your machining operations. Circle C Bits have a tool life many times greater than that of ordinary high speed steel.

An order for a few bits will show you the possibilities of establishing machining costs on a much lower scale. Literature and price list on request.



Circle ©
High Speed Steel
TOOLHOLDER BITS

FIRTH-STERLING STEEL COMPANY

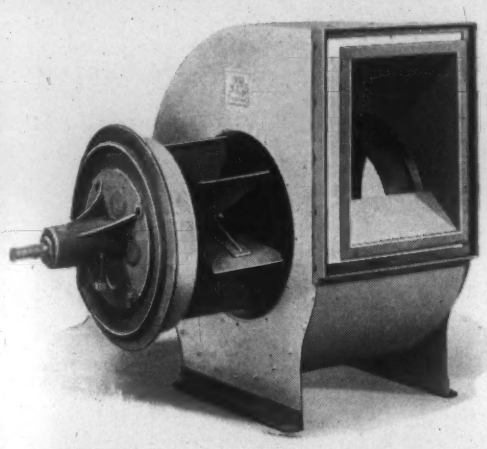
Works: McKEESPORT, PA.
NEW YORK CHICAGO HARTFORD
CLEVELAND DETROIT LOS ANGELES
PHILADELPHIA DAYTON

High Temperature Thermo Exhausters

The Industrial Gas Engineering Co., 201 East Ohio St., Chicago, announces a new improved line of high temperature exhausters in addition to their regular line of Thermo Exhausters introduced 10 years ago.

The new high temperature exhausters embody many improvements and are manufactured in a wider range of types and sizes for various temperatures. They are available in the patented double housing insulated and air-cooled construction, also in a single housing uninsulated construction for applications where uninsulated equipment is satisfactory.

All parts subjected to high temperatures are fabricated of various heat-resisting alloys best



suited to the operating temperatures. Double row self-aligning ball bearings are used and these are kept cool by a patented air cooling method which prevents the transmission of heat to the shaft, to the bearings, keeping also the shaft cool and rigid and eliminating the troublesome water cooling.

A convenient access to the exhauster wheels is provided, the complete assembly wheel, shaft and bearings being readily removable by the removal of the cap screws which fasten the assembly to the exhauster housing.

All new types of Thermo Exhausters are made in three stock class, class "L" for operating temperatures up to 800° F., class "M" for operating temperatures up to 1000° F., and class "H" for operating temperatures up to 1250° F. Special units can be furnished for higher temperatures up to 1800° F.

The "Combustrol" for Controlling Combustion

The "Combustrol", manufactured by the General Combustion Corp., Chicago, has been completely redesigned. It is claimed to safeguard ovens, furnaces, heaters, kilns, and combustion equipment against explosion. This protection is claimed to consist essentially in (1) Following a set, safe cycle in lighting the burners, and (2) complete shut-off of fuel lines in case of pilot failure. The safety cycle of lighting is performed automatically by the control cabinet, and its operation is simple and fundamental.

The Combustrol affords additional protection in the form of a time delay period preceding actual lighting operations. It is a complete unit

mechanically, consisting of time delay, automatic ignition means, necessary switches automatically operated which open and close the gas valves, and pilot bull's-eye indicator which indicate the status of the operative circuit.

The apparatus is 10 in. wide by 6½ in high by 5 in. deep. Mounting holes are provided in the back of the case.

A Spot-Welding Fixture

This fixture is designed for the Progressive Hydraulic Welding Gun for uniting sheet-metal parts in medium production systems. These fixtures, designed by the Progressive Welder Co., 737 Piquette Ave., Detroit, specialists in production welding quipment, are comparatively inexpensive because of the simple method of fabrication and will more than pay for the extra investment over make-shift set-ups. The parts to be welded are clamped and positioned by quick acting devices, so that the finished assembly will fit its corresponding parts. The copper bus-bars are cast to fit the parts to be welded, insuring uniform identical assemblies. The transformer and hydraulic booster for the hydraulic welding gun, are mounted in the fixture making a compact unit, a real advantage in shops having limited floor space. The compact and accessible arrangement of all clamping devices, the placing of the work for loading and unloading with minimum handling, the ease of handling and positioning the hydraulic spot-welding gun are features of this very efficient unit. Only connection to air, water and electrical source are necessary to put this machine in operation. As all production fixtures are entirely different and every one a special custom-built job, this company because of its experience and knowledge of spot-welding problems offers a real service to production and manufacturing plants.

A Barium Ladle Addition

A ladle addition for acid or basic steel for ingots or castings, with the name "Bar-Flux", is offered by the Si-Lux Co., Investment Bldg., Pittsburgh. It is a patented barium compound. It is also manufactured in grades suitable for use with non-ferrous metals. Among some of the claims made for it are: It retains heat in and increases the fluidity of the metal, it is both a de-gasifier and a deoxidizor, it repels inclusions, it removes S, P, and other impurities, it lowers the melting point and lessens the viscosity of slags, and so on.

Only Chapmanizing

GIVES YOU THESE 4

HEAT-TREATING ADVANTAGES

Design and production engineers find unexpected opportunities for product improvement and cost reduction in these characteristics of the Chapmanizing process for surface-hardening steels:

1. **Low-cost steels are given the hardness of costly alloys — up to 1000 Brinnell.**
2. **In ⅓ the time, Chapmanizing gives a surface that outwears carburizing 9 to 1. Machining and grinding time is also cut.**
3. **Case of any depth from .002″ to .035″, tough yet ductile . . . won't chip, flake, corrode, warp, distort.**
4. **No capital investment. Use your present set-up . . . install the Chapmanizing Unit on a contract basis.**

Send for new illustrated book containing complete engineering information.

S.A.E. 1020 STEEL CHAPMANIZED 2 HRS.
CHAPMANIZED
NITRIDING STEEL NITRIDED 70 HRS.
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New Equipment for Industrial Spectrography

In modern industrial laboratories, the importance of spectrum analysis has been acknowledged and is gaining popularity. Recently, a set of spectrographic instruments, specially designed for qualitative and quantitative analyses, has been made available for this purpose. This set consists of the Quartz Spectrograph "Qu 24," the Feussner Sparking Apparatus, the Spectrum Line Photometer, and the Spectrum Projector, all made by Carl Zeiss, Jena, or 485 Fifth Ave., New York. The applications of the "Qu 24" are:

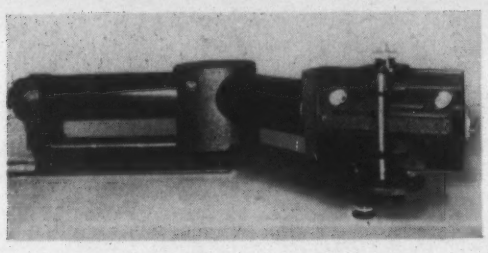
1. In emission spectrum analyses for quantitative work in solid, liquid and powdered substances.

2. In absorption spectrum analyses for investigating the absorptive properties of liquids and solids.

For this kind of work, the instrument covers a range in the ultra-violet region up to 2000 A.

The features of the "Qu 24" are:

1. An optical system of high luminosity with an effective aperture ratio of F/11.2.



2. Permanently aligned parts, which do not require any adjustment by the user.

3. A flat spectrum, which allows the use of commercial plates.

4. Perfect definition combined with high resolving power.

One of the outstanding qualities a spectrograph should have is definition, which must not be confused with dispersion. Definition is all important because modern methods of evaluation consist of enlarging the spectrogram by projection in order to make possible objective evaluation with the help of a photometer, or visual analyses by means of a spectrum-projector. Therefore, the original spectrogram should be needle-sharp and show maximum definition. Dispersion, or a long drawn out spectrum, is not of primary importance, because the necessary "blow-up" is attained by the projection in the evaluating process. Owing to the progress that has been made in the construction of objectives, it is now possible to condense the spectrum from 2000 to 58000 A. on a plate of 223 mm. length and yet attain a resolution and definition, which separates lines of a wave-length difference of only 0.34 A. Thus, the three iron lines at 3100 A., between which there is a wave-length difference of only 0.338 to 0.362 A., are perfectly separated.

Reliable results in quantitative analysis do not only depend on the spectrograph, but also on the sparkling apparatus. Conditions in the latter must be maintained at a constant, and the emanating energy should always be alike. In the patented Feussner sparking apparatus, a rotating spark gap, driven by a synchronized motor, assures that discharges only take place at a given voltage and that a definite number of high frequency oscillations accompany each discharge.

The Spectrum Line Photometer serves for the evaluation of spectrograms in quantitative analyses. The instrument enlarges the spectrogram from 15 to 30 times, and the intensity of lines is measured with the help of a photo-electric cell. The accuracy of the Spectrum Line Photometer is 0.1% of the measured content. In other words, if the content of an element is for instance 5%, the accuracy is 0.005%.

For qualitative evaluation, a spectrum projector has been constructed, which shows the spectrum at a magnification of about 20 times. The spectrum is projected onto a wide horizontal base-board, where it can be simultaneously observed by several people and evaluated in comfort.

Fatigue phenomena, occurring in microscopic evaluation because of the small field of view, which hinders a general survey, as well as strain on the eyes, are thus eliminated.

Westinghouse 250-Watt Symmetrical Angle Reflectors

Westinghouse "250-Watt Symmetrical Angle Reflectors" are designed especially for use with high intensity mercury lamps. They provide ideal illumination where intensive local lighting of vertical and horizontal surfaces from the side is required.

The reflector, with diffusing glass cover, is designed to give a widespread distribution of light horizontally, and an even distribution of light from top to bottom of the vertical surface. It is drawn from 24 gage iron sheet. One ground coat of porcelain enamel is applied all over and two coats of white porcelain enamel inside and one green coat outside with two black beads provide the reflecting surface and covering.

The acid etched glass cover is hinged directly to the reflector bead, supported at three points. It is released by unsnapping two latches. A heavy waterproof felt provides a gasket between reflector and lens.

A One-Piece Welding Helmet

A welding helmet of entirely new design is offered by Willson Products, Inc., Reading, Pa., manufacturers of protective devices for head, eyes, nose, throat and lungs. Formed of one-piece black vulcanized fibre and cut deeply to offer side protection to a point well back of the ears, the new helmet is said to have greater ruggedness to withstand hard shop use. The usual riveted, lapped-over seams or joints

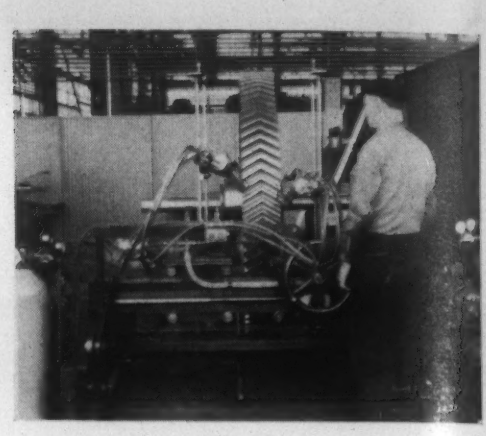
are eliminated; a smooth, rounded interior promotes air circulation and results in a well ventilated, cool, comfortable helmet. A 2 x 4¼ in. Willson-Weld glass is standard in the new helmets. The Willson company is making several different styles of helmets in one-piece construction. The new line also includes one-piece handshields.

New Gear Hardening Machine

A new torch gear-hardening machine that does 4 times as much work in a given time as the ordinary gear-hardener has recently been perfected and patented by Farrel-Birmingham Co., Inc., Buffalo, N. Y. It not only saves time and labor but reduces gas consumption and offers such fine adjustments of burners and water jets that the desired depth and uniformity of hardness are exactly secured.

While specially designed to harden double helical or herringbone gear teeth, this new machine is equally efficient for hardening single helical or straight-tooth gears, splines of rolling mill wabblers, sprocket wheels and similar parts.

It has two separate torch heads, and each head carries two sets of torches or tips. Therefore, both sides of the gear tooth and both helices of a double helical gear are hardened simultaneously. This is a great advance in efficiency over the single-head type of torch, for the latter hardens only one side of the tooth, doing only one quarter as much work in the same time.



In hardening double helical gears one torch head of the machine starts hardening at one end of the tooth while the other torch head begins at the other end. They travel toward the center or apex of the gear tooth on a horizontal traverse, but an ingenious device allows the torches to practically follow the helical trace of the teeth. This device is a guide roller on the torch carrier which engages the gear being hardened between two teeth and thus revolves the gear in correct relationship to the horizontal traverse of the torches.

The traveling speed of the torches and attached water jets is regulated by a variable speed gear. It is generally from 6 to 10 in. per min., according to the tooth size.

A single lever controls the pilot lights for igniting the torches and their gas supply. Water pressure from a 250-gal. tank is kept constant and at correct volume by a centrifugal motor-driven pump equipped with a relief valve and other necessary fittings. This overcomes the difficulty of variable water pressure commonly encountered in most cities. To enable the machine to handle any range of work, quickly adjustable burners of seven different sizes are supplied.

Ingenious Plug-In Instruments Developed

Industrial plants will particularly benefit by the newly developed plug-in instrument whose self-supporting socket can be mounted directly in the wiring conduit with a 35 percent saving over a conventional installation, according to Westinghouse engineers. Industries powered by individual drive, such as the machine and textile industries, will particularly benefit since the development makes practical the low cost use of instruments to act as guide for "production speed vs. machine life".

With 4 yrs., development behind it, the present universal socket will give any desired load conditions by merely plugging in an ammeter, voltmeter, watthour meter, etc., one after another in the same socket. Standard "troughs" (all metal boxes), with several sockets, will be used when more than one instrument is to be read at the same time, and can be mounted much like a motor starter. Quick and easy mounting has been worked out for ordinary wiring, such as rigid conduit, open wiring or cable.

Improved Stabilog Potentiometer Controller

The general reliability and appearance of the "Foxboro Stabilog Potentiometer Controller" have been developed excellently by various improvements made recently in the instrument. A new universal coil plate, housed in a bakelite molded housing, which also now contains the standard cell, stands out among these improvements very noticeably. By enclosing the resistance coils of the measuring

system, eliminating exposed wiring and cleaning up the general appearance of the interior side of the inner door, this development has made a decided change in the appearance of the instrument.

Platinum contacts on the slide wire. Vernier type rheostate and replaceable gold alloy galvanometer suspensions are other additions which not only improve the appearance of the unit, but also aid greatly in accuracy of operation.

New Ceramic Material for Laboratory Table Tops

Stuart M. Phelps and Edward E. Marbaker of Mellon Institute, Pittsburgh, have described the development of a new laboratory table-top material called "Kemite". Its properties are such that it fulfills the exacting requirements of scientific laboratory service and does not have any of the disadvantages of the materials commonly used for this purpose.

Kemite consists essentially of an easily moldable ceramic body into which has been incorporated carbonaceous substances to increase the porosity after firing. It also contains artificially-prepared cordierite, a mineral having an exceptionally low thermal expansion. This body, after molding, drying and firing, is completely impregnated under pressure with liquid bitumens, and then subjected to a heat treatment during which the volatile matter is expelled. A residue of carbon in the form of coke fills the pores, rendering the body dense and imparting to it an attractive black color. Kemite is smooth, hard, strong, practically impervious to liquids, and very resistant to the action of acids and alkalies. Because of its low thermal expansion, when locally heated and cooled rapidly, it does not crack or spall. It retains its pleasing appearance under severe laboratory conditions.

While developed primarily as a table-top material, the characteristics of Kemite suggest its use in other kinds of laboratory and chemical plant equipment. In another form called "Karcite", in which cordierite is not present, it is being used for sinks, tanks, drain pipe, pipe fittings, and window sills. In building construction, it can be employed in such forms as sanitary ware, partitions, roofing, flooring, waintscoting, stair treads, and shelves.

Other information about Kemite and Karcite may be obtained from Mellon Institute, Pittsburgh.

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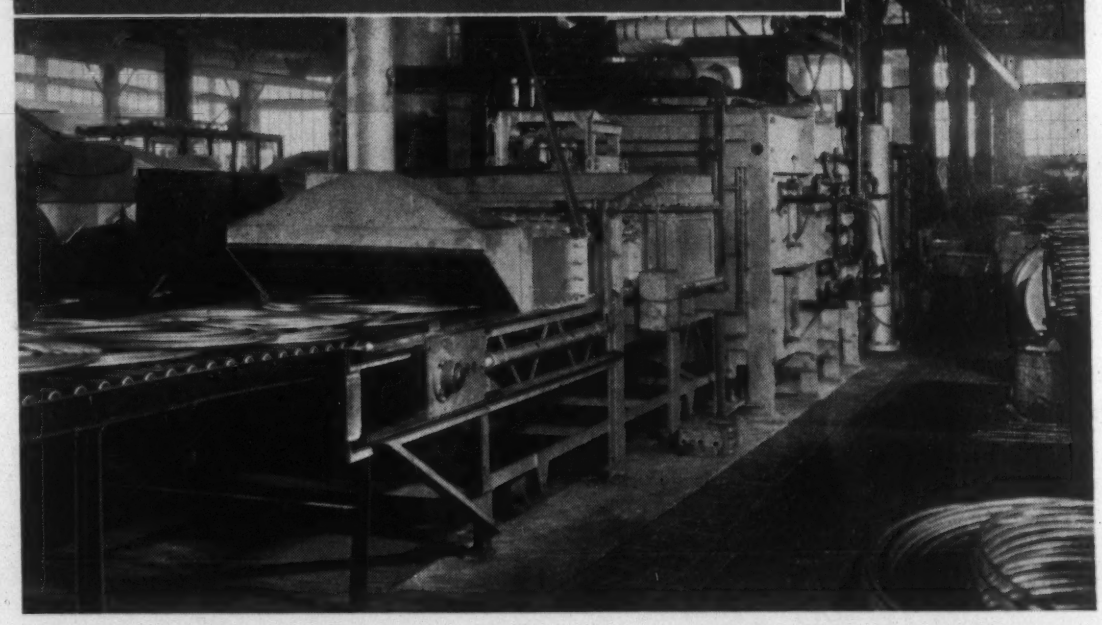

Armstrong's EF-22 Insulating Fire Brick assure more efficient operation of this modern furnace for coil brass work. The furnace is gas fired, of the conveyor type.

IN all types of furnaces—coal, oil, gas fired, or electrically heated, Armstrong's Insulating Fire Brick assure greater fuel savings, more uniform temperatures, more efficient operation, and increased output.

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